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CONTENTS

Analytical Studies of Group Behavior in Birds	By W. C. Allee	145-151
Notes on the Horned Larks of the Central Ohio Region	By Charles F. Walker and Milton B. Trautman	151-155
Thomas Leroy Hankinson	By Norman A. Wood	156-158
Frequency of Occurrence of Summer Birds in Northern Michigan	By Jean M. Linsdale	158-163
An Unusual Colony of Alder Flycatchers	By Louis W. Campbell	164-168
A Study of the Ring-billed Gull in Alberta	By J. A. Munro	169-180
Franklin J. W. Schmidt	By Aldo Leopold	181-186
Winter Food of the Sharp-tailed Grouse and Pinnated Grouse in Wisconsin	By F. J. W. Schmidt	186-203
The First Descriptions of North American Birds	By O. A. Stevens	203-215
Observations on Nests and Young of the Coot	By George O. Hendrickson	216-218
General Notes		219-224
Communications		225
Editorial		226
Membership Roll		227-240

THE WILSON BULLETIN

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THE WILSON ORNITHOLOGICAL CLUB

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ANALYTICAL STUDIES OF GROUP BEHAVIOR IN BIRDS[1]

BY W. C. ALLEE

The bird flock as a social organization is again receiving a part of the attention it deserves. With increase in facility in marking individuals, there has come new and valuable information regarding some aspects of the intimate social structure of bird groups. Some of the earlier work was reviewed by Allee (1931, 1934); the most spectacular of the modern trends was initiated by Schjelderup-Ebbe who has recently summarized his own studies (1935). In this latest summary, Schjelderup-Ebbe says (p. 949), "One of the points which the recognition of each individual bird in the flock of the same species makes it possible to observe is that *there exists among birds a definite order of precedence or social distinctions.*[2] The precedence in rank proved to be founded upon certain *conditions of despotism.* Between any two birds of each species, in a large number of species examined, one individual *invariably* had precedence over the other . . ." Schjelderup-Ebbe records that he has observed such despotism in over fifty species of birds including the common chicken, a common sparrow, various ducks, geese, pheasants, cockatoos, parrots, various tits, and the common caged canary.

Stimulated by Schjelderup-Ebbe's early observations, for several years at Chicago, we have been accumulating data concerning the social hierarchy in some few species of birds. Our experience with the common chicken (Masure and Allee, 1934a) is similar to that of Schjelderup-Ebbe, Murchison, and other observers. With the other birds, our observations differ significantly.

Masure and I found first with pigeons that the position in the social order is not so firmly fixed that one bird of a given contact pair always is dominant and the other always gives way. Rather we found that individual relationships in the flocks of pigeons which we

[1]This report is a review of studies published or to be published in detail elsewhere.

[2]All italics as in the original.

studied were give and take affairs. To be sure one bird of any two usually dominated more than it retreated. In a flock of seven male pigeons, in only two of the twenty-one possible pairs did the same bird win all the observed contact reactions. In the other nineteen pairs, the loser, on the average, won twenty-three and lost forty of the observed pair contacts.

In the similar group of sex segregated female pigeons, no single bird dominated any other individual in all their observed pair contacts; rather the loser won an average of twenty-five and lost an average of forty-five such encounters. One bird, *RY*, stood at the bottom of the social order at first and came to dominate the whole female flock in the end. Even in the twenty-eight days during which we studied her while she occupied the dominant position, she lost fifty-eight contact reactions while winning 329. All the other members of the flock, except one, won over her during her period of dominance; one of them as many as twenty-two times that we witnessed.

There is also a place factor in the dominant-subordinate relationship. Among these female pigeons, at one time, *BB* dominated at the entrance to the roost, while *BY* won the majority of all her contacts on the ground.

With shell parrakeets, Masure and I (1934b) found a similar sort of flock organization except that among the female flock of seven, during our somewhat brief period of observations, there were six of the twenty-one contact pairs in which one female had been regularly submissive or had engaged in "no decision" contacts; among the males there were four such cases again out of twenty-one possible pairs. Of the others, the loser among the females on the average, won five and lost twenty-nine of the observed decisive contacts. The corresponding figures among the sex segregated flock of males are six and twenty-seven, respectively.

Since these data were published, Miss Mary Bennett has observed the same win-and-lose sort of organization among ring doves, and Mr. Hurst Shoemaker has made extensive observations with canaries and more incidental ones with a flock composed of five White-throated and one White-crowned Sparrow. Among the canaries, he finds the give-and-take relationship; with the sparrows, there is apparently a greater fixity, but even with them a reversal has been observed in the same hour's observation and without an unusually violent struggle.

In all these birds in which this now-one-wins-now-the-other reaction takes place, there is no evidence that the reversals are unusual reactions as they undoubtedly are among chickens. In the same hour,

one canary or pigeon or ring dove may dominate in a given contact and the other of that particular contact pair may dominate at their very next meeting.

The picture that emerges is one of a flock organized into a social hierarchy which, however, is not necessarily so hard and fast as that of chickens. In the long run in such groups, one becomes fairly sure which of two given individuals will dominate in the larger number of their contacts, but the result of any one meeting is not predictable with certainty.

Putting the matter somewhat facetiously, all of Schjelderup-Ebbe's birds and American chickens as well appear to have the sort of "line organization", which is characteristic of a military system or of a Fascist or Nazi state while the birds we have studied, chickens excepted, have a more democratic organization. The sort of hierarchy found among chickens may be characterized as being based on an almost absolute peck-right while that we have seen in pigeons, ring doves, canaries, and perhaps in sparrows, is based on what may be called a peck-dominance.

With many birds there is a definite social prestige related to sex. The usual report is that the more showy or larger sex is dominant. With the shell parrakeets which we have tested, the females are distinctly dominant except during the breeding season when the dominance shifts to the other sex. In shell parrakeets the two sexes are closely similar in coloration and size. The males tend to be less shy in the presence of an observer but in a mixed flock they are clearly dominated much of the year by the females. Even the low ranking birds in a homosexual flock dominated the high ranking males when placed with them.

It has been reported by others (Katz and Toll, 1923) that in chickens there is a positive correlation between ability to learn and social position; with the parrakeets, Masure and I found no such correlation. This is one of the points that Mr. Shoemaker is now testing with canaries.

Masure and Allee (1934b) suggested that high rank in the social order could easily have survival value during times of food shortage, a suggestion which needs to be tested by exact observation. Murchison (1935d) subjected a flock of chickens to mild starvation and found that the dominant roosters lost more weight than those lower in the social scale and that, in fact, loss of weight was directly proportional to social position. This is explicable in terms of the behavior differences he found to be associated with social position, a matter which will be examined shortly.

It would be extremely interesting and important to make further analyses of the underlying physiology of the social hierarchy. Such experiments might well proceed along two different lines. In the first place, using a white breed, such as the white leghorn chicken, one could alter coloration of birds with known social status and ascertain whether color is an important recognition mark in these social hierarchies. Such experiments would have immediate significance in relation to the whole question of recognition color markings. Along the same line of experimentation, contour lines could also be modified by plucking or cutting feathers, e. g., or by some other method, and test thereby the importance of this factor in social recognition.

More significant investigation would endeavor to alter experimentally the physiological state of selected birds of known status in the social group. The injection of sex hormones, e. g., and many of the other devices of the students of sex physiology, would give an excellent chance for testing the social effects of these active physiological agents. The possibilities of experimental work along this line are almost as varied as the probable results are important and fascinating. Preliminary experiments indicate that positive results may be expected.

Another aspect of this problem has been somewhat investigated already. This is concerned with the effect, direct social order contacts aside, of the presence of other individuals on the behavior of any given member of the flock. With chickens, Murchison has recently reported a series of studies covering certain phases of these reactions. When released from behind glass doors into a narrow runway, cocks will run toward each other; the one higher in the social order will run the greater distance (1935a). When two cocks from the same flock are confined in wire cages some six feet apart, and a third member of the flock is released into the enclosure containing the cages under the conditions of the experiment, the free bird, if a male, goes toward the caged cock that is lower in the social hierarchy; if a female, it goes toward the cock that is higher in the hierarchy (1935b).

Three of the six cocks in the one flock Murchison studied did not exhibit primary sexual behavior; of the other three, the number of treadings, other conditions being similar, were in order of the relative dominance of the cock, with the most dominant bird treading pullets most frequently. Also the dominant female was most trod of the pullets and the number of treadings of the other females was in direct relation to their position in the social scale; the pullet lowest in the social hierarchy received the least sexual attention (1935c). These last observations are in accordance with the findings of Masure and

Allee that birds high in the social scale have more contact reactions per unit of time than do those low in the social order in the same flock.

Another type of interaction between individual birds has been tested by Allee and Masure (1936). The fact that shell parrakeets are closely flocking species led us to an extended study of the rate of learning of these birds in a simple two-alley "problem" box when isolated and when paired. From observations on other animals it seemed likely that the parrakeets might learn more rapidly if paired, but this expectation was not realized.

Both isolated and paired parrakeets showed rapid improvement in speed of reaction and in reduction of errors with repeated trials in the simple "problem" box which was used. Under both conditions, the period of most rapid learning lasted from ten to twelve days, after which there was a long, slow improvement for weeks until, in the majority of cases, the animals came to run rapidly and surely through the maze. The standard criterion of excellence set for the birds was the running of five trials per day for two successive days without errors. Often the birds would run through the maze in a mean time of five seconds or even less, per trial when on their first performance, they would take on the order of 200 seconds or more.

Throughout these tests, the paired birds showed significantly slower reaction times and tended to make more errors than isolated birds of the same stock and with similar treatment. Although paired parrakeets can become as well trained as their isolated fellows, the training period usually takes longer and final performance tends to be more erratic.

Parrakeets caged in pairs and trained alone show learning curves very similar to those given by others caged as well as trained singly. When paired and isolated birds which had become well trained to go toward green rather than toward red light had their grouping reversed, the newly isolated birds showed less disturbance than the newly paired individuals. When birds so trained to respond to the green of the green-red signal were rearranged with the paired birds isolated and the formerly isolated birds paired, and then trained to go toward blue in a blue-yellow signal, the change in signal appeared to be more disturbing than the change in social relationship.

Incidentally, some of these parrakeets retained marked effects of their training for a period of from six to eight months during which time they had passed through a breeding season in an outdoor aviary. No attempt was made to determine the relative retention by paired and by isolated birds.

The two lots of parrakeets whose training was continued into the spring season exhibited an unexplained disturbance in their maze performance probably associated with a foreshadowing of the breeding period. Both isolated and paired birds showed the disturbance; the paired birds more than the isolated ones. Throughout the work, however, there was no evidence that the heterosexual pairs behaved differently in the maze, from the homosexual pairs.

There was a decided tendency for birds of a pair to give similar reaction times and to make the same errors in any one run through the maze. The presence of the second individual was often a disturbing factor; apparently it introduced a sort of distraction such as has usually been found in similar experiments with other animals.

Summary

1. The social order among chickens and perhaps in the observed sparrows is of the relatively firmly fixed, despotic sort originally described by Schjelderup-Ebbe.

2. In pigeons, shell parrakeets, ring doves, and canaries, the social order, while distinctly recognizable, is less firmly fixed; subordinate individuals normally "win" a minority of their pair contacts.

3. Promising lines of investigation of intra-flock relationships are suggested.

4. Within the flock, individual members react on others in ways not directly concerned with the establishing and maintaining of a social hierarchy. These reactions include differential behavior to the various individuals in the flock, as analyzed by Murchison for chickens, and the distracting effects that result from the presence of a second shell parrakeet during training in running a simple maze.

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NOTES ON THE HORNED LARKS OF THE CENTRAL OHIO REGION

BY CHARLES F. WALKER AND MILTON B. TRAUTMAN

The status of the various races of the Horned Lark (*Otocoris alpestris*) that occur in Ohio has received little attention from Ohio ornithologists. The following notes are based upon observations and collections made during the course of more than 1000 field trips in the central part of the state over a twelve-year period from 1922 to 1933, chiefly near Columbus and at Buckeye Lake, but also at numerous other localities in the counties of Union, Delaware, Franklin, Licking, Fairfield, and Pickaway, all in the till plains province of the state. As a matter of convenience we have referred to this area as "Central Ohio", but such generalizations as occur in these notes are not intended to apply beyond the limits outlined above. Particular attention was given to the winter population in an effort to determine approximately the relative abundance of the three races, *Otocoris alpestris alpestris*, *O. a. praticola*, and *O. a. hoyti*.

Under favorable conditions of light the great majority of individuals may be accurately identified in the field. Many such identifications have been checked by collecting. During the winter the gregarious habits of the Horned Lark make possible the close comparison of individuals, and the slight differences in size and color that characterize the different races become relatively conspicuous.

The Prairie Horned Lark (*Otocoris alpestris praticola*) is a moderately common although somewhat local breeding bird in central

Ohio, nesting most frequently in well-drained pasture fields. Males defend their territories as early as the first week of February, and nearly all of the breeding individuals are present by the last of that month. This is also true in northwestern Ohio where the bird nests much more abundantly than in the central part of the state.

The only nest of which we have record in central Ohio was found by Dr. Robert B. Gordon on March 24, 1930, near the O'Shaughnessy Reservoir in Delaware County, and contained three eggs in an advanced stage of incubation. Several nesting records from northern and northwestern Ohio indicate that the first complement of eggs is normally laid in late March. Adult larks feeding young birds out of the nest have been seen at Buckeye Lake as early as April 20 and as late as June 2.

During the summer and early fall months single birds and small groups including as many as ten or twelve individuals may be encountered along dusty roads and in closely cropped pastures or stubble fields. At these seasons the larks are inconspicuous. During late September and October flocks of as many as thirty birds are occasionally seen. By December a marked decrease has occurred, and during the latter half of that month and the first half of January Prairie Horned Larks are decidedly uncommon, and in some years perhaps entirely absent.

Sometime during late January or February, depending upon weather conditions, there is a decided influx of birds of this race; small, loosely associated groups appear at the nesting grounds and the males may be found singing from frozen clods of earth, or, especially when the ground is covered with snow, from fenceposts. Even where flocks of the Northern Horned Lark (*O. a. alpestris*) are present in the same field, there is little or no association of the two races, and behavior at this season serves to differentiate them quite as satisfactorily as do the morphological characters.

We have examined eight central Ohio specimens of the Prairie Horned Lark in the Ohio State Museum collection which beyond reasonable doubt represent breeding individuals. On the whole they agree closely in color and size with the description of *praticola* as given by Oberholser (Proc. U. S. Nat. Mus., V. 24, 1902, p. 825). In none of these birds is there any trace of yellow in the posterior portion of the superciliary line.[1] In a series of sixteen males collected

[1]We have, however, seen one breeding specimen (O. S. M. 6979) from Lucas County, Ohio, in which the superciliary line is uniformly pale yellow, although in other details of coloration and in size the specimen is typical of *praticola*.

between November and May, the wing length ranges from 102.6 to 108.1 mm., while two females have wing lengths of 97.1 and 99.8.

The Northern Horned Lark (*O. a. alpestris*) is unquestionably the dominant race during the winter months. Our earliest fall record is that of a flock of approximately twenty-five birds seen on a sandbar at Buckeye Lake on October 11, 1928. Flocks of from twenty to one hundred individuals are usually present by early November. The peak of abundance occurs during December, January, and February when flocks of 200 or more are frequently encountered. The largest flock noted by us was estimated to contain 600 individuals and was seen in the cornfields of the Scioto River bottom-lands a few miles south of Columbus on February 18, 1928. The largest number recorded in a single day was that of an estimated 2000 individuals, the combined number of several flocks which were encountered along a three mile stretch of road immediately south of Buckeye Lake on February 14, 1929. During the month of March there is a rapid decline in numbers and our latest date is March 29, 1930, when a flock of twelve birds was seen near Buckeye Lake.

The size of the winter population varies greatly from year to year and is apparently correlated with the amount of snow on the ground and the availability of food. Low temperature seems not to be a factor. Many of the flocks inhabit those areas in which *praticola* nests in the spring, and where weed seeds and cultivated grains are accessible. Fields in which livestock is fed and where waste grain is consequently abundant, and fields in which manure has been scattered seem to be particularly attractive. In such situations the birds are usually able to find food even during periods of heavy snowfall.

The Northern Horned Lark is characteristically gregarious during the entire period that it occurs in this region. On warm spring days a short and presumably incomplete song is frequently heard, usually delivered while the bird is in flight. At no time, however, does the singer fly far from the flock. Occasionally an individual sings from the ground while associated with the flock. We have never seen a Northern Horned Lark sing from an elevated perch as does our nesting race, *praticola*. In spite of the gregarious habits of the northern bird, spirited and prolonged combats often occur between individuals of the flock. These have been most frequently noted on warm days late in the winter and may be indications of the approaching breeding season.

The Ohio State Museum collection includes thirteen central Ohio specimens of *O. a. alpestris*. Among these are individuals with throat

and superciliary line fully as rich a shade of yellow as any Massachusetts or Long Island specimen that we have examined. In others the yellow color of these parts is distinctly pale but these latter birds agree with the former in size and in the rich dark tones of the upperparts and seem to be unquestionably referable to the race *alpestris*. The wing length in males of this series ranges from 109.7 to 114.4 mm. and in females from 100.6 to 105.2.

Three additional specimens are decidedly atypical although nearer to *alpestris* than to any other of the subspecies. One of these (O. S. M. 3072), a female with a wing length of 100.5 mm., has an extremely pale yellow throat and superciliary line, the dorsal color, however, is darker than in *praticola* and there is a faint yellowish suffusion in the brownish crown feathers. Two other specimens, males (O. S. M. 3065, 3068), exhibit similar departures from the normal *alpestris* coloration, but are so large (wing length 110 mm. in each) that we conclude they represent intergrades between *alpestris* and *hoyti*. These two birds were taken from flocks largely comprised of typical individuals of *alpestris*. Another specimen (O. S. M. 3061) seems so clearly intermediate between *alpestris* and *hoyti* that we hesitate to refer it definitely to either race. This bird was collected at Buckeye Lake on December 29, 1928. From the same flock were taken: a female (O. S. M. 3073) which seems typical of *alpestris*, the atypical male of *alpestris* (3068) mentioned above and a pair of larks (3077, 3088) which seem clearly referable to *hoyti*. These specimens were selected, after careful study, from a large flock in which by far the majority of individuals showed the yellow superciliary line of *alpestris*.

Hoyt's Horned Lark (*Otocoris alpestris hoyti*) is by far the rarest of the three races that occur in this region. Most of our records are of one or two individuals associated with large flocks of *O. a. alpestris*. These birds, with the white superciliary line and pale dorsal coloration of *praticola*, but fully as large as the *alpestris* with which they associate, are not difficult to identify in the field. The greatest number recorded, on December 29, 1928, at Buckeye Lake, was five in a flock estimated to contain 100 individuals of *alpestris*. Many large winter flocks of larks which we have carefully examined contained no *hoyti* nor have we found any flocks composed entirely of *hoyti*. The available central Ohio records for this race range from November 26 (Oberholser, Wilson Bulletin, Vol. 31, 1919, p. 64) to March 17. Upon a few occasions we have heard a short song from individuals of this race, and twice our attention was first attracted to the birds by

a peculiar quality of the voice which seemed distinctly different from that of *alpestris*.

Only six specimens which are clearly referable to *hoyti* have been collected.[2] The wing length of the five males ranges from 110.2 to 113.4 mm., while that of the one female is 106.2. The superciliary line in all six specimens is white and the colors of the head and back are lighter than in *alpestris* and lack the brownish tones characteristic of that race. There is much variation in the intensity and extent of the yellow throat patch.

The status of the three races of Horned Larks in central Ohio may be briefly summarized as follows:

O. a. alpestris is overwhelmingly the commonest race in winter, occurring characteristically in large flocks which may also include a small proportion of integrades between *alpestris* and other races, and a few individuals of *hoyti*. The nesting race, *O. a. praticola*, is rare or even absent during a short period from about December 15 to January 20, and is not known to occur in large compact flocks at any time.

As regards the ratio of *alpestris* and *praticola* our observations in central Ohio are quite at variance with those of Dr. Lynds Jones, made in the Cedar Point region of northern Ohio (WILSON BULLETIN, 1910, pp. 29-30). According to Jones, "winter flocks of these larks are almost always mixed in the proportion of 2 of *alpestris* to 7 of *praticola*." From our own limited observations in northwestern Ohio we gather that *praticola* is a much commoner midwinter bird there than in the central area, and the extensive field work carried on by Messrs. Louis W. and Bernard R. Campbell in the Toledo region also indicates. that this is true.

It is possible that the smaller number of *praticola* in central Ohio in winter is correlated with the smaller breeding population, although it might be expected *a priori* that winter flocks would include *praticola* from northern Ohio and Ontario as well as *alpestris* from regions farther north. It seems quite apparent that the ratio of the two races in winter populations varies greatly in different localities in Ohio and that some factors other than climate must be taken into consideration to explain these differences. Due to local, seasonal, and yearly variations it is impracticable to attempt an exact expression of the ratio of the various races in our winter Horned Lark population.

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[2]The identifications of two or these have been confirmed by Dr. H. C. Oberholser.

THOMAS LEROY HANKINSON

BY NORMAN A. WOOD

Witmer Stone says, "Ornithologists are born, not made", and in the passing, on December 3, 1935, of Mr. Hankinson, we lost one of the most successful and enthusiastic teachers of ornithology.

Born April 12, 1876, at Valparaiso, Indiana, he lost his parents at an early age, and was given a home by an uncle at Hillsdale, Michigan, where he developed the intense love of natural history which shaped his life work. An important association of his early life was that with Prof. Walter B. Barrows, under whom he studied at the Michigan Agricultural College, until his graduation, with the degree of B.S., in 1898. He then studied at Cornell University, receiving another B.S. degree in 1900. From 1902 to 1919 he held the position of Professor of Zoology and Physiology at the Eastern Illinois State Normal College, at Charleston. From 1919 to 1921 he was Ichthyologist at the Roosevelt Wild Life Forest Experiment Station of the New York State College of Forestry. From 1921 until his death he was Professor of Zoology at the Michigan State Normal College, at Ypsilanti. In 1923 he was given the honorary title of Visiting Investigator in the Fish Division of the Museum of Zoology, University of Michigan.

Professor Hankinson was elected an Associate Member of the American Ornithologists Union in 1897. He joined the Wilson Ornithological Club in 1911, served as Secretary in 1915, and as President from 1922 to 1924. He was Treasurer of the Illinois Academy of Science from 1917 to 1919; Treasurer of the American Society of Ichthyologists and Herpetologists in 1930-31; Vice-President of the Ecological Society of America in 1919; Treasurer of the American Microscopical Society from 1910 to 1915, and Vice-President in 1916; a member of the Executive Board of the Michigan Audubon Society from 1922 to 1927, and First Vice-President from 1925 to 1927.

He took part in natural history surveys in New York, Ohio, Michigan, Illinois, and North Dakota, and as a result of these studies published a number of papers on the classification, habits, and distribution of the birds, and also, more especially, of the fishes of these states. His ornithological papers were published mainly in the *Bulletin of the Michigan Ornithological Club*, *Bird-Lore*, and the *Auk*. Unfortunately, he left a large amount of unpublished data, mostly in the field of ichthyology. However, his greatest contribution to science was doubtless his long and unusually successful career as a teacher of zoology. Few in his field have been as effective in giving students an enduring interest in the study of the fascinating world of wild life all

THOMAS LEROY HANKINSON, 1876-1935

about them. His personal interest in his students was greatly appreciated, and he was universally well liked by them.

The writer became acquainted with Mr. Hankinson while he was a student at the Michigan Agricultural College in 1897. We were both elected Associate Editors of the *Bulletin of the Michigan Ornithological Club*, where in Volume 1, Number 1, pages 1-4, was published his paper on "Progress of Ornithology in Michigan", a very complete outline of the work that had been accomplished up to 1897, giving the names, dates, and lists published by the early ornithologists of the state. While other interests occupied most of his time, he has always been greatly interested in birds, and he has furnished the Museum of Zoology with valuable data and some study specimens, all of which are here gratefully acknowledged. We deeply regret the loss of a valued friend and co-worker of many years standing.

Museum of Zoology, University of Michigan,
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FREQUENCY OF OCCURRENCE OF SUMMER BIRDS IN NORTHERN MICHIGAN

BY JEAN M. LINSDALE

Twice I have given detailed accounts of a procedure for determining and describing the frequency of occurrence of birds on restricted areas. (See *Condor*, Vol. 30, 1928, pp. 180-184, and Vol. 34, 1932, pp. 221-226). The method has been worked out for studies of plants, but its application to birds is so simple, and the records needed for its use are so nearly the same as those ordinarily kept by bird watchers, that it deserves more attention from bird students than it has received.

The materials used here are the result of fifty days' work in the field in the vicinity of Douglas Lake, Cheboygan County, Michigan, in the summer of 1924. The first work was done on June 9 and the last on August 17. During the first three weeks only a part of each day was spent in the field, but in the latter part of the season whole days are represented in the records. Special attention was given to the nesting birds and their local distribution. During the summer 106 kinds of birds were found; a few of these were early migrants. Because many accounts of the environment in this vicinity have been given by other workers and because a detailed analysis of the birds of the region has been prepared by Professor F. N. Blanchard (MS.),

I intend to discuss only the single topic, frequency of occurrence of the summer birds.

For the kind of analysis attempted here more records are desirable than are available, but I believe that the ranking of the species would not be changed greatly by additional material. It would be useful in studying populations of birds to have comparable determinations of relative frequency of occurrence of the species from many localities. In this country hundreds of persons have kept records of the birds observed by them each in a restricted locality. With very little effort these records could be analyzed and concise summaries of them from the point of view of the Raunkiaer law of frequence prepared and published. Some of the refinements of method suggested by Dice (*Auk*, Vol. 47, 1930, pp. 22-24) would add considerably to the value of such results; but with most observers it probably is not practicable to apply them, or at least they have not been applied in the records already made.

Raunkiaer derived what he called the Law of Frequence from eleven pieces of botanical work carried on by himself and others in different parts of Europe. In nearly all such surveys it is learned that there are many more species of low frequence than of high frequence. A curve expressing the numbers in the different classes of frequence has two peaks, a high one expressing the least frequence, and a lower one expressing the greatest frequence. If the species of frequences of respectively 1-20 per cent, 21-40 per cent, 41-60 per cent, 61-80 per cent, and 81-100 per cent are grouped into classes designated as A, B, C, D, and E, the law of frequence might be expressed A>B>C>, equal to, or <D<E (Kenoyer, Ecology, Vol. 8, 1927, p. 343).

To avoid duplication of matter contained in previous discussions, I will repeat only a few points which deserve special emphasis. The importance of studies of bird populations and the difficulties encountered in making them are commonly recognized. Adaptations of methods developed in connection with the Raunkiaer law of frequence offer suitable means of analysis of frequency in birds. For this purpose the lists of birds customarily kept by bird watchers provide sufficient materials if they pertain to a single limited locality or single type of habitat. Days appear to be suitable units for observational records, thus shifting the basis for analysis to units of time rather than of space. As to the number of units, this may vary considerably depending upon such factors as size and uniformity of the area and seasonal distribution of the time; but I suspect that, where possible,

it is best to have records for one hundred days or more and extending throughout the annual cycle. The percentage of frequency for each species is obtained simply by dividing the number of days on which the species was observed by the total number of days on which observations were made.

Besides furnishing an opportunity for application of the method of frequency analysis to a new locality these records can be compared with another set of figures intended to show the relative numbers of summer birds in the same vicinity. J. S. Compton (Wilson Bulletin,

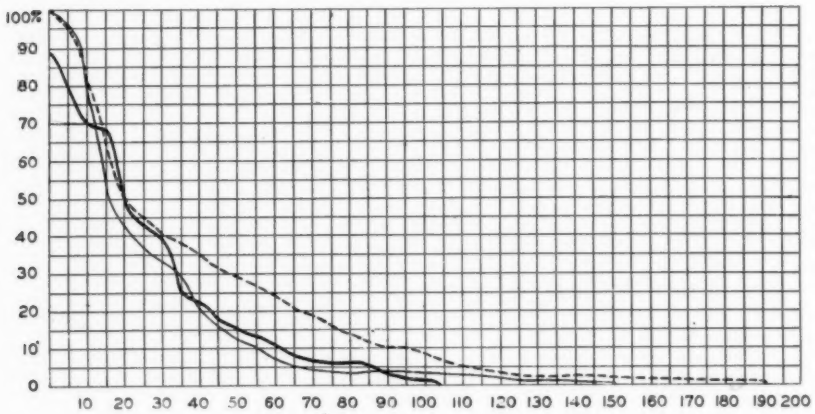

Fig. 29. Graph showing relative frequency of occurrence of the species of birds recorded in three localities: Doniphan County, Kansas (dotted line); Yosemite Valley, California (light, solid line); Cheboygan County, Michigan (heavy, solid line). Each curve represents the percentages of frequence for all the species in a single locality. For example, the heavy, solid line shows how the percentages for the 103 species recorded in Michigan are arranged between the extremes of 88 and 2. On this graph most frequent species are indicated on the left and least frequent ones toward the right.

Vol. 26, 1914, pp. 173-180) observed birds in this vicinity during the summer of 1913 and 1914. He used the term frequency to express the "comparative frequency with which the species, not the individual, was seen." In this connection he used three degrees as follows: "r or rare=seen 1 to 4 times; c or common=seen from 5 to 20 times; a or abundant=seen more than 20 times." He explained that "abundance, on the other hand, applies to the total number of individuals of the different species seen during a given period; in this case the period covers from June 30 to August 7, stopping before the fall migration gets any headway to disturb our study of midsummer birds. (1) under abundance means that this species stands highest in number of individual birds seen, 227 in our study; at the other end of the scale of

abundance (47) means that only 1 bird of this species was identified."

Compton's determinations of frequency and abundance have been placed in the following table (second and third columns) along with my own figures expressing percentage of frequency (first column) according to the Raunkiaer law. Because the records were made by two separate persons, in different years, and with different objectives the results are not exactly comparable, but from the point of view of accurate description and economy of time, as well as ease of comprehension, the percentage of frequency seems to be the most satisfactory.

TABLE 1. Classification of Species According to Raunkiaer's Law and Compton's Determinations.

Species	Percentage of Frequency	Frequency	Abundance
Eastern Robin	88	a	17
Eastern Kingbird	88	a	15
Cedar Waxwing	84	a	1
Eastern Nighthawk	84	a	10
Eastern Chipping Sparrow	82	a	13
Eastern Song Sparrow	78	a	2
Red-eyed Towhee	78	a	4
Eastern Crow	76	a	3
Eastern Hermit Thrush	74	a	9
Spotted Sandpiper	72	a	6
Northern Flicker	72	a	14
Red-eyed Vireo	72	a	5
Eastern Whip-poor-will	70	a	12
Eastern Goldfinch	70	a	7
Brown Thrasher	68	c	26
Eastern Cowbird	60	c	24
Oven-bird	58	c	11
Eastern Belted Kingfisher	56	a	16
Eastern Vesper Sparrow	56	a	8
Eastern Wood Pewee	50	a	19
Northern Blue Jay	50	c	26
Slate-colored Junco	50	a	15
Caspian Tern	48	c	33
American Redstart	46	a	14
Black-capped Chickadee	44	c	21
Eastern Mourning Dove	42	r	46
Killdeer	40	c	23
Eastern Ruffed Grouse	40	a	20
Eastern Phoebe	40	c	43
Rough-winged Swallow	40	—	—
Eastern House Wren	40	c	30
Common Tern	34	r	46
Black-throated Green Warbler	34	c	29
Black and White Warbler	26	c	34
Black-billed Cuckoo	24	r	44
Chimney Swift	24	a	26
Least Flycatcher	24	r	45
Indigo Bunting	24	c	23
Barn Swallow	24	r	45
Bronzed Grackle	22	r	46
Eastern Winter Wren	22	c	23
Great Blue Heron	20	c	43
English Sparrow	20	c	20

Species	Percentage of Frequency	Frequency	Abundance
Eastern Meadowlark	18	r	38
Eastern Golden-crowned Kinglet	18	c	39
Eastern Red-wing	16	c	42
Eastern Purple Finch	16	c	39
Scarlet Tanager	16	c	36
American Merganser	14	—	—
Osprey	14	r	46
Prairie Horned Lark	14	r	43
Myrtle Warbler	14	r	46
Magnolia Warbler	14	—	—
Herring Gull	12	—	—
Ring-billed Gull	12	—	—
Northern Crested Flycatcher	12	r	47
Chestnut-sided Warbler	12	c	21
Red-breasted Nuthatch	12	r	46
Red-headed Woodpecker	10	c	42
Purple Martin	10	r	46
Veery	10	r	46
American Bittern	8	r	47
Marsh Hawk	8	c	42
Eastern Hairy Woodpecker	8	c	36
Northern Downy Woodpecker	8	a	25
Bobolink	8	r	43
White-throated Sparrow	8	a	18
Tree Swallow	8	c	28
Migrant Shrike	8	—	—
Mourning Warbler	8	—	—
Canada Warbler	8	r	43
Catbird	8	r	42
Brown Creeper	8	r	46
Wilson Snipe	6	—	—
Eastern Sparrow Hawk	6	r	45
Great Horned Owl	6	—	—
Yellow-bellied Sapsucker	6	a	20
Eastern Savannah Sparrow	6	r	45
Black-throated Blue Warbler	6	r	40
Blackburnian Warbler	6	r	44
Northern Pine Warbler	6	c	34
Olive-backed Thrush	6	r	41
Common Black Duck	4	—	—
Sharp-shinned Hawk	4	r	46
Eastern Goshawk	4	—	—
Olive-sided Flycatcher	4	r	46
Northern Pine Siskin	4	—	—
Clay-colored Sparrow	4	—	—
Northern Cliff Swallow	4	c	32
Bank Swallow	4	r	44
Eastern Yellow Warbler	4	r	46
Pied-billed Grebe	2	r	47
Piping Plover	2	—	—
Virginia Rail	2	r	46
Sora	2	—	—
Least Sandpiper	2	—	—
American Woodcock	2	—	—
Northern Red-shouldered Hawk	2	—	—
Southern Bald Eagle	2	r	43
Ruby-throated Hummingbird	2	c	42
Alder Flycatcher	2	—	—
Eastern Field Sparrow	2	r	47
Northern Parula Warbler	2	—	—

TABLE 2. Comparison of the Five Classes of Frequency for Three Localities.

	Michigan		Kansas		California	
	Species	Ratio	Species	Ratio	Species	Ratio
A	62	.59	133	.68	111	.73
B	16	.15	32	.16	20	.13
C	11	.10	13	.07	7	.05
D	10	.09	6	.03	5	.03
E	5	.05	10	.05	8	.05

The five classes, A, B, C, D, E, include the species of frequency of, respectively, 1-20 per cent, 21-40 per cent, 41-60 per cent, 61-80 per cent, and 81-100 per cent. Each ratio represents the relation between the number of species in each group and the number of species recorded for that area. In general the distribution of the Michigan species among the classes of frequency resembles that of the other two localities. The differences probably result from restriction of observations in the former to the summer season and from the small number of days represented.

I anticipate that further tests of this method in other localities will demonstrate its usefulness as a device for analyzing the composition of the avifauna. Everywhere, it is to be expected, many more species will prove to be of low frequence than of high frequence. However, these species of low frequence may be among the most important in the make-up of the wild animal population. They are likely to be ones of great interest to their human associates. Birds of prey, large species, and the smaller rarities, even when they come in the lowest frequency class, are the ones which contribute most to the attractiveness of wilderness areas and the outdoors in general for the person who watches birds. It is the natural proportions between species, as revealed by analyses of populations, that we should strive to maintain in our conservational activities. This original composition of an avifauna is so complex that we can scarcely hope to understand or to describe it without the aid of some simple device such as the one based on the Raunkiaer law. It has been demonstrated over and over that an important result of the ordinary kind of human occupation of land is to remove the species of low frequence or to lower their frequency of occurrence and to increase the frequency of occurrence of a few species, usually ones already common.

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AN UNUSUAL COLONY OF ALDER FLYCATCHERS

BY LOUIS W. CAMPBELL

About one mile south of the village of Whitehouse in Waterville Township, Lucas County, Ohio, a colony of Alder Flycatchers (*Empidonax t. trailli*) has chosen an unusual nesting place. One ordinarily associates this species with brushy swamp borders or at least creek bottoms, but this group of some six or eight pairs has selected a dry pasture, thickly overgrown with shrubs and small trees, as a nesting ground. The nearest water is the winding south branch of Swan Creek about one-half mile to the southeast.

The land in this district is very flat. From the top of the stream bank there is a gradual rise of about twenty feet to the general locality of the nesting place, which is slightly higher than the surrounding country. This is due to the fact that the underlying limestone is here within a foot or so of the surface of the earth—in fact, it outcrops at several points.

The place where the nests were found is about one and one-half acres and forms the southern portion of a three and one-half acre field, about 750 feet long by 200 feet in width. The nesting area is quite level, broken only by a trench ten feet wide and less than three feet deep which cuts diagonally across the field and then parallels for about a hundred feet the road which bounds the field to the west. This trench has been cut into the solid rock, the result of a minor quarrying operation. After a heavy rain it may contain some surface water but I have never found any on my trips. About 250 feet north of the area studied and separated by a more open area are two quarry holes, roughly fifty feet in diameter and five feet deep. These holes are dry and show no evidence of having contained water in recent years. From August 1-17, 1935, three and forty-four one-hundredths (3.44) inches of rain fell, yet when I visited the place on August 26 there was no trace of surface water. However, a more moist condition at the bottom of these quarries is indicated by the presence of a few stunted willows and a thick blanket of fog fruit (*Lippia lanceolata* Michx.). Beyond the holes and on all other sides, the pasture is surrounded by open fields except for a small grove of chestnut oaks (*Quercus Muhlenbergii* Engelm) averaging one foot in diameter, west of the road and immediately adjacent to the location of the nesting sites.

What grass there is is kept very low by grazing cattle but much of the ground is covered by shrubs and small trees; cock's spur hawthorn (*Crataegus Crus-Galli* L.), wild crabapple (*Malus coronaria*

(L) Mill.), black haw (*Viburnum prunifolium* L.), hazel nut (*Corylus americana* Walt.), and prickly ash (*Zanthoxylum americanum* Mill.). The last two are represented by only a few plants. Growing in and along the trench mentioned above are a few taller trees; none of which, however, are more than six inches in diameter; black locust (*Gleditsia triacanthos* L.), sycamore, elm, and two black ash saplings. At the eastern border is one large elm fifteen inches in diameter and one small sycamore. The character of the soil is further indicated by the following plants: hounds' tongue (*Cynoglossum officinale* L.), hairy beard-tongue (*Pentstemon hirsutus* (L) Willd.), yarrow (*Achillea millefolium* L.), fleabane (*Erigeron ramosus* (Walt.) B.S.P.),

FIG. 30. Typical crataegus nesting site of "upland" Alder Flycatchers. May 25, 1935, Waterville Township, Lucas County, Ohio.

horseweed (*Leptilon canadense* (L) Britton), mullen (*Verbascum thapsus* L.), flowering spurge (*Tithymalopsis corollata* (L) K. I. & Garcke), mountain mint (*Koellia virginiana* (L) Mac. M.), wild bergamot (*Monarda mollis* L.), catnip (*Nepeta cataria* L.), rock sandwort (*Arenaria stricta* Michx.), small skullcap (*Scutellaria parvula* Michx.), catsfoot (*Antennaria* sp.), prairie ragwort (*Senecio plattensis* Nutt.). Of the above, eight species indicate dry soil.

Birds other than the flycatchers which nested in this area were: Mourning Doves, Catbirds, Brown Thrashers, Robins, Field Sparrows, and one pair each of House Wrens, Mocking-birds, Yellow Warblers,

and Chipping Sparrows. Three nests of the flycatchers were found, all build in the same pattern, in cockspur hawthorn. As may be seen from the accompanying photograph of nest No. 1, they are not typical Alder Flycatcher nests, being less bulky and placed on the upper side of a nearly horizontal branch instead of in a crotch. Nest No. 1 was found on July 10, 1934, about three and one-half feet from the earth. This nest was placed on a branch which was almost perfectly horizontal. It contained three eggs with large embryos. The female was collected at the nest. Concerning the eggs Dr. Charles F. Walker, then assistant curator of Natural History at Ohio State Museum, writes: "They are rather more heavily spotted than our eggs of *trailli* but we have one set that is quite as much spotted as yours. There seems to be quite a bit of variation in the eggs of these birds."

Nest No. 2 was found June 23, 1934, four feet from the ground, and contained three eggs. The nest was empty when collected July 28. Nest No. 3, found June 27, 1935, was four and one-half feet from the earth and nearer the end of the supporting branch than the other nests. It contained four eggs which, in contrast to those of Nest No. 1, were scarcely marked at all. On July 6 there were two eggs, one fledgling, and one egg just hatching. On July 17 the nest had disappeared. This nest was not photographed or measured.

That this nest-building habit is not characteristic of this particular group is shown by the photograph of a similar nest (No. 4) which was found July 16, 1935, twelve miles northeast of Whitehouse in typical creek-bottom habitat about 100 feet from Swan Creek. This nest was situated on the outer branch of a small elm tree at a sharper angle than the Whitehouse nests, and about seven feet from the earth. It contained three well feathered young. On July 24 the empty nest and a fledgling nearby were collected.

Measurements in millimeters of the three nests taken are as follows:

	Width		Height	
	Maximum	Inside	Maximum	Inside
No. 1	90	53	65	34
No. 2	85	50	62	38
No. 4	100	58	60	32
[1]Typical		50.8		38.1

Except for a slight difference in voice, these "upland" Alder Flycatchers were true to type. Fresh specimens taken here and in a wet prairie showed no difference in coloration. Measurements of specimens taken are shown in millimeters in the following tabulation:

[1]Howard Jones, "Nests and Eggs of Our Common Birds", 1927.

FIG. 31. Nest No. 1, built in a crataegus tree. Nests No. 2 and No. 3 were very similar to this nest. July 10, 1934, Waterville Township, Lucas County, Ohio.

FIG. 32. Nest No. 4, built in a small elm tree in a typical creek bottom habitat. July 24, 1935. Adams Township, Lucas County, Ohio.

Date	Length	Wing	Tail	Culmen	Width of Culmen at Base	Weight
(1) June 21, 1934.....	♂ 136	70.6	54.5	12	8	
(2) July 28, 1934.....	♂ 147	70.1	53.5	11.9	8	
(3) July 11, 1935.....	♂ 136	71.8	60	11.8	8	14.13 gr.
[2]Ridgway's Average..	♂ 133	71.8	58.4	12.0		
(4) July 10, 1934.....	♀ 131	67.1	54.5	11.5	8	
[2]Ridgway's Average..	♀ 130	68.4	55.4	11.7		

Judging bird voices is a very difficult matter—so much depends upon the ear and judgment of the listener. It was my impression, however, that the Alder Flycatchers of this colony had voices much weaker, pitched higher, and less husky than is typical. Their quality was more like that of the Acadian Flycatcher. The familiar *whis-kee* call was given much less frequently than normal, and sounded much more like *whée-be* or rarely *whip-wheu-whip*. In several hours' observations at different times and on different days, this call was heard less than ten times. On the other hand, the *whip* or *wheep* note was given almost constantly. This was not due to fright as the birds were not shy. On one occasion a rapid succession of calls somewhat like a flight song was heard which I was unable to record.

No attempt will be made to explain the presence of this small colony of Alder Flycatchers in such an unusual location. However, it may be that the birds chose this place during consecutive years in which there was heavy rainfall during late May and June and having established themselves remained through dryer years.

Conclusions

These birds are true Alder Flycatchers in an abnormal habitat.

The voices of these birds are slightly different than other Lucas County Alder Flycatchers.

The nests are unusual but not confined to this group.

If the presence of this colony is due to water collecting in the quarry holes, trees in the bottom of the holes indicate that it must have developed within the last ten or fifteen years.

I wish to express my thanks to Mr. Lawrence D. Hiett of Toledo, Ohio, for his excellent photographs, and to Prof. John H. Schaffner and Dr. Charles F. Walker of Columbus, Ohio, and Dr. J. Van Tyne of Ann Arbor, Michigan, for aid and criticism.

Toledo, Ohio.

[2]Ridgway, "Birds of North and Middle America", 1907, p. 558.

A STUDY OF THE RING-BILLED GULL IN ALBERTA

BY J. A. MUNRO

The existence of a large gull colony on Goose Island in Bittern Lake, Alberta, was discovered in 1927 by Mr. Frank L. Farley, who, in the years following, banded approximately a thousand nestlings each year. This author states (Birds of the Battle River Region of Central Alberta, The Institute of Applied Art, Ltd., Edmonton, Alberta, 1932), "When this colony was discovered in 1927, California Gulls appeared to greatly out-number the ringbills. In 1931 it looked as though there had been an entire reversal of status, and the opinion was freely expressed by banding operators that the ringbills were then in the majority."

Different conditions prevailed in 1932, when I first visited the island in company with Mr. Farley, and during the two years following. In those years the population, which remained fairly constant at 1400 to 1600 adults, estimated, was composed almost entirely of Ring-billed Gulls (*Larus delawarensis*). More precisely in 1932 I identified positively only five, and in 1933 twenty, as California Gulls, while in 1934 no individuals of this species were seen. The possibility of mistakes in identification is admitted. It is often difficult to distinguish between adults of the two species particularly so, perhaps, when the birds are in flight which is the aspect most commonly viewed by the observer on a nesting colony, unless detailed study is being conducted from a blind. The relative size of the two gulls is an unsatisfactory means of identification because there is little difference in this respect between the male Ring-billed Gull and the female California Gull, and in any case one frequently is deceived by the apparent size of a gull as anyone who has collected them will testify. The best diagnostic character separating the two species in life appears to be the dark band on the bill of the Ring-billed Gull and upon this feature I placed chief reliance as a means of identification.

Downy young of the two species can be separated by the whiter head of *californicus*, and juvenals can be distinguished readily for the reason that *californicus* in this stage is much the darker of the two. I found no downy young, and only one juvenile California Gull on Goose Island.

Examination of several hundred clutches of eggs revealed none which, by greater size, could be ascribed to the California Gull. One nest upon which lay a dead female California Gull was assumed to be of this species and in this case the eggs did not appear to be any

larger or to have any markings which would serve to distinguish them from those of the Ring-billed Gull.

Incidental to this it might be mentioned that during fourteen years' field work (1921 to 1935) in Alberta and Saskatchewan I found the California Gull to be less common than would be anticipated from reading the literature, most of it published prior to that time. One is obliged to conclude either that this species is becoming less common or else that some of the earlier Canadian prairie records are based on mistaken identification.

However that may be it is certain that during the years 1932 to 1934 Goose Island was colonized chiefly by the Ring-billed Gull, and therefore it may be assumed that at least 95 per cent of the food material discussed later in this paper was taken by this species.

My visits to the colony were on the following dates: June 19, 1932; May 26, 27, 1933; June 2, 1934.

Description of locality. Bittern Lake, comprising at high water mark some seventeen square miles of shallow water, is contained chiefly in Township 47, Range 21, and Township 47, Range 22, west of the Fourth Meridian. It is surrounded by rolling, broken prairie largely under cultivation but retaining remnants of the original trembling aspen, and balm-of-gilead growth on the less arable portions. The shores are low, bare, and for the most part composed of heavy clay. In some places are intrusions of hard sand, some of which are mixed with boulders. The water is strongly alkaline and supports little hydrophytic vegetation or aquatic animal life.

Goose Island in earlier times of high water was the most easterly situated of two low-lying islands close to the north end and nearest to the west shore of the lake. With a progressive shrinkage of the water area during the past decade the island nearest the shore increased in size with the accretion of exposed lake bottom and finally joined the mainland to form a wide peninsula from the end of which Goose Island was separated by a shallow channel. By 1932 the intervening water was reduced to a width of forty feet and in the summer of 1933 and 1934 the channel was dry, the two islands thus forming a continuous extension of the mainland.

Goose Island proper is circular in shape with a well-defined point at the east side. It comprises several acres of relatively fertile land, rich in plant life, at an elevation of five feet or so above the surrounding barren expanse of exposed lake bottom which supports no vegetation other than the alkaline-loving skunk grass. The vegetation on the island consists of low willows, a luxuriant growth of vetch repre-

sented by several species, various grasses, silver weed (*Potentilla anserina*) on the more open sandy places, lambs' quarters, dandelions, and other imported weeds.

Mr. Farley has told me of paddling to the island from the east shore of the lake at a time when the willow bluffs, only a few yards from the water's edge, outlined the edge of a narrow shelving beach when the lake water was clean enough for human use and the island vegetation not infected by introduced weeds. Such times would seem definitely to be in the past, and the present surroundings of exposed lake bottom in its drab barrenness are in striking contrast to what formerly existed.

Behavior. As we left the mainland shore and crossed the exposed lake bottom white masses of gulls could be seen in the distance above the short vegetation on the island. While we still were distant some three hundred yards from this objective some of the gulls flew toward us at no great height, and after wheeling over-head several times followed or preceded us toward the island. When we reached the nesting grounds the gulls circled above us quite low, constantly planing earthward in short, savage swoops, so that a rush of air from their cleaving wings could be felt on the cheek.

This was on June 19, 1932, when some of the young were well advanced. In the two following years, when the island was visited earlier in the season and most of the nests contained eggs, the gulls showed less concern at our arrival and I was able to approach close enough to obtain photographs of the sitting birds. At these times the majority of the birds did not rise until we were within fifty yards or so and after a few demonstrative attacks they settled on the water close to the shore.

Nests. Each year the colony consisted of three separate, well-defined nesting areas. The largest one, near the west side of the island, was restricted to a strip of beach roughly one hundred and fifty yards by fifty yards. This was uneven ground including a boulder-strewn terrain, defining a former high water mark but now twenty yards distant from the lake edge, and the outer portion of a grass belt which extended inland to the edge of the willow bluffs. This contained 376 nests in 1934. Two hundred yards east was a second group of forty nests similarly situated and on the point at the east side of the island was the third nesting ground containing 300 nests. These were much closer together than was the case elsewhere. Some almost touched and it was not unusual to find four or five nests within a space of four square yards or less. This crowded section of

more or less circular shape, with its trampled vegetation, the smooth, worn appearance of numerous hummocks, the accumulation of feathers and the white splashings of excrement, was conspicuous indeed amongst the surrounding growth of grasses and vetches.

The chief nesting material was a fine, wiry grass of local origin and other plant material was used less extensively. In some cases filamentous algae to which clay had adhered were an important constitutent and nests thus reinforced were substantial structures eight to ten inches high. But the majority were less than half this height and some were simple rings of dry vegetation surrounding the eggs. One grass nest some distance away from the others on what formerly was lake bottom had been built beside the skull of a large bison bull, which was used as a perch. This was one of several bison skulls which, preserved under water for many years and during that interval stained a rich, rusty orange through some chemical action, had recently been uncovered by the receding waters.

Eggs. The majority of nests contained three eggs, which seems to be the maximum laid by one bird. Clutches of four or five were not uncommon but in such cases a difference in coloration of one or two eggs indicated that a second female was involved. One nest containing seven eggs was noted. The great variety of ground color and blotching was astonishing, indeed there was speculation as to whether two clutches of identical appearance could be found. Some of the combinations of light ground color and dark, massed blotching were handsome enough to stir dormant oölogical emotions in the hearts of the investigators.

It is of interest to record that a freshly laid Robin's egg was found in a gull's nest! No Robins nest on the island.

On May 26, 1933, most of the nests contained a full complement of eggs and none had hatched. On June 19, 1932, nests with eggs were still in evidence.

Young. On June 2, 1934, about 50 per cent of the nests, approximately 350, contained recently hatched young, the earliest about one week old. Two distinct color phases, gray and fawn, are apparent, the former being much the more common. In a few cases one fawn-colored and two gray downy young were together in a nest but it was usual to find the two color phases separated.

Well developed young were the rule on June 19, 1932. When disturbed by our walking through the nesting ground these youngsters sought shelter amongst the thick vegetation farther inland. Large birds after running quickly to some place of partial concealment

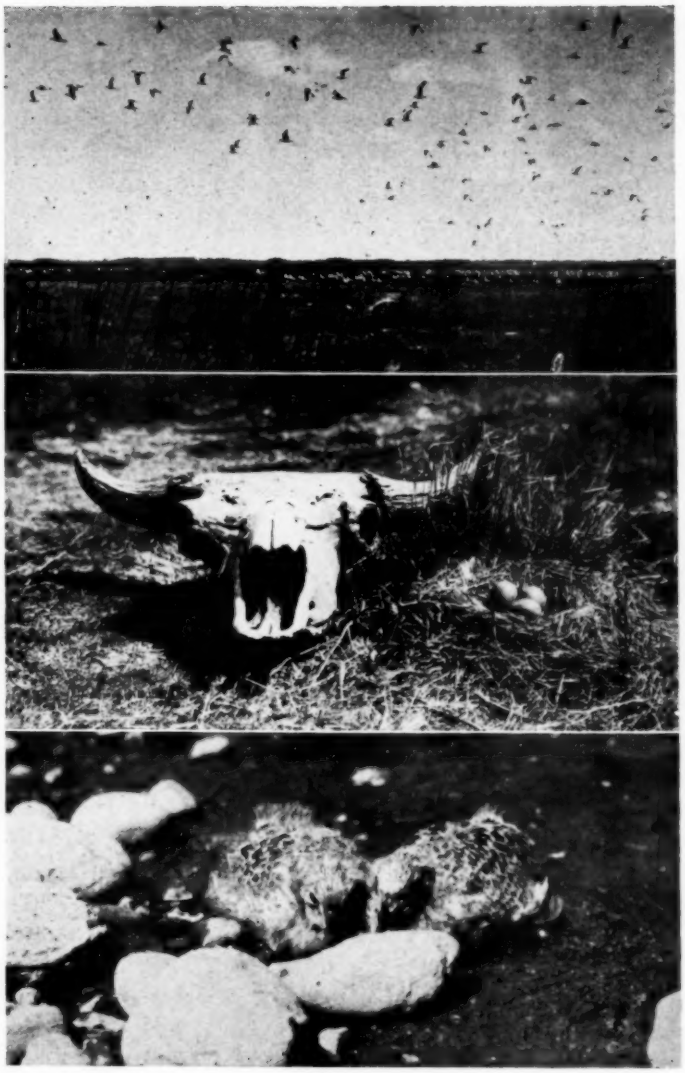


FIG. 33. Nesting colony of Ring-billed Gulls, at Bittern Lake, Alberta (above). Nest of a Ring-billed Gull at the side of a bison skull (middle). Young Ring-billed Gulls (below). Photographs by J. A. Munro, and loaned by courtesy of the National Parks of Canada.

would crouch in the grass or against an earth hummock or boulder until the observer attempted to pick them up, whereupon they again would scuttle off. Younger birds on the other hand after the initial run would lie prostrate and could be handled at will.

Casualties. As in all gull colonies, dead adults showing no external marks of injury frequently were discovered. On June 19, 1934, the bodies of nine adult Ring-billed Gulls and one California Gull in the plumage of the third year were counted on the open parts of the island. No casualties amongst the young were noted on June 2, 1934, at a time when most of the young were newly hatched, but on June 19, 1932, when the average age of the young was perhaps two weeks, a considerable mortality was observed. The carcasses of 200 birds of various ages were scattered about on the open ground and it seems likely that other dead young were concealed in the thick vegetation.

Enemies. With the drying up of the last winter barrier between mainland and island it was thought probable that the gulls would desert the colony because of possible depredations by mammal predators. This proved unfounded and the population did not even decrease. Search was made for tracks of coyote or skunk approaching from the mainland but no evidence of this was found. A few crows nest in the willows on the island but no evidence of their having destroyed gulls' eggs or young was obtained. In 1934 a herd of sheep was turned out on the island in care of a resident shepherd. It is not known how the gulls fared under this visitation.

Food. The barren shores and alkaline waters of Bittern Lake provide little food for gulls. The only evidence of animal life found on the muddy beaches comprised the shells of two species of mollusca, neither of which was common. These have been identified by the United States National Museum as *Succinea grosvenori* Lea and *Stagnicola palustris elodes* Say. Other data concerning the animal life in the lake are not available.

Just how far these gulls travel in search of food is not known. They are seen through the summer hunting over cultivated fields and prairies in the district adjacent to the lake and they visit the city dump at Camrose, fifteen miles or so distant. But no doubt daily trips are made for distances much greater than this.

An important food is Richardson's ground squirrel (*Citellus richardsoni*). Large numbers of skulls and other remains of this animal were found on the island where they had been carried by the gulls. Perhaps the majority of these represented carrion for it is difficult

to conceive of a Ring-billed Gull capturing so large an animal. Hundreds of ground squirrels are killed on the roads by motor cars and it is a common sight to see gulls, crows, and occasionally other birds tearing at the carcasses. No doubt such casualties explain the chief source of this food supply. Sometimes Ring-billed Gulls attempt to swallow a ground squirrel too large for their capacity of ingestion, with fatal results. I found no less than five dead gulls, each with the hind end of a ground squirrel protruding from the mouth.

Other food data were obtained through the examination of thirty-seven regurgitated pellets recorded as follows.

MAY 26, 1933

1. Husks and broken kernels of wheat, 98 per cent; a few beetle fragments, 2 per cent.

2. Pieces of straw, 40 per cent; cowhair, 45 per cent; beetle fragments, 5 per cent.

3. Hard parts of small ground beetles, *Carabidae*, representing at least twenty-five individuals, 90 per cent; pieces of straw and wheat kernels, 10 per cent; several pieces of gravel.

4. A quantity of wheat husks and one whole kernel, 98 per cent; fragments of a ground beetle, 2 per cent; several pieces of gravel.

JUNE 2, 1934

Contents of thirty-three pellets from nesting colony at Bittern Lake, Alberta, collected June 2, 1934.

5. Fragment of bird's trachea, 10 per cent; elytra and other fragments of Carabid beetle; one beetle larva, 25 per cent; vegetable matter including dry grass, thistle seeds, and rootlets, 65 per cent.

6. Wheat, 99 per cent; elytra carabid beetle, 1 per cent.

7. Wheat, 95 per cent; other vegetable matter, 5 per cent.

8. Wheat, 98 per cent; grass fragments and vegetable debris, 2 per cent.

9. Rami and parts of upper mandible of a gallinaceous bird, possible Gray Partridge (*Perdix perdix*), 10 per cent; hair and bone fragments of ground squirrel (*Citellus richardsoni*), 10 per cent; parts of wild oats, 5 per cent; wheat, 30 per cent; vegetable debris, 44 per cent; insect fragments (chitin), 1 per cent.

10. Pupal cases of Diptera, 95 per cent; vegetable debris, 5 per cent.

11. Oats, 30 per cent; wild oats, 5 per cent; vegetable debris including coarse sawdust, 59 per cent; cowhair, 1 per cent.

12. Oat husks, 30 per cent; coarse sawdust, 68 per cent; fragments Diptera pupal cases, 1 per cent; cowhair, 1 per cent.

13. Oats, 28 per cent; wild oat husks, 2 per cent; coarse sawdust, 65 per cent; fragments of elytra and tarsus of at least two Carabid beetles, 2 per cent.

14. Wheat, 99 per cent; piece of a mollusc shell, 1 per cent.

15. Wheat, 60 per cent; oats, 10 per cent; vegetable debris, 30 per cent.

16. Wheat, 100 per cent.

17. Shell fragments of duck's eggs and egg lining, 15 per cent; pupal cases of Diptera, 10 per cent; vegetable debris including rootlets, 75 per cent.

18. Pupal cases of Diptera (app. 100), 90 per cent; vegetable debris, 8 per cent; cowhair, 2 per cent.

19. Wheat, 55 per cent; oats, 5 per cent; vegetable debris, 35 per cent; cowhair, 5 per cent.

20. Two lower mandibles, leg bones, and hair of vole, 100 per cent.

21. Wheat, 50 per cent; elytra and other Carabid beetles, 40 per cent; vegetable debris including *Carex* seed, 10 per cent.

22. Wheat, 100 per cent.

23. Wheat, 95 per cent; two small mammalian bones, possibly *Citellus*, 4 per cent; mollusc shell fragment, 1 per cent.

24. Wheat 100 per cent.

25. Hair and bones of one adult, three juvenile voles, 100 per cent.

26. Pupal cases of Diptera, 25 per cent; cowhair, 75 per cent.

27. Wheat, 48 per cent; oats, 2 per cent; coarse sawdust, 46 per cent; cowhair, 3 per cent; insect fragments, 1 per cent.

28. Wheat, 55 per cent; oats, 4 per cent; wild oat fragments, 1 per cent; coarse sawdust and vegetable debris, 37 per cent; cowhair, 2 per cent; insect fragments, 1 per cent.

29. Wheat, 98 per cent; vegetable debris including two *Carex* seeds, 2 per cent.

30. Wheat, 100 per cent.

31. Pupal cases of Diptera (app. 150), 98 per cent; cowhair, 2 per cent.

32. Wheat, 96 per cent; oats, 3 per cent; insect fragments, 1 per cent.

33. Bones and hair of at least two voles, 100 per cent.

34. Bones and hair of at least two voles, 100 per cent.

35. Wheat, 70 per cent; oats, 10 per cent; vegetable debris, 19 per cent; fragments of pupal cases of Diptera, 1 per cent.

36. Wheat, 45 per cent; cowhair, 45 per cent; fragmentary pupal cases of Diptera, 5 per cent; vegetable debris, 5 per cent.

37. Hair and bones of one ground squirrel, *Citellus richardsoni*, 100 per cent.

List of Items	Percentage Frequency	Percentage Occurrence	Average Percentage Volume
Wheat	21.8	57.6	78.6
Oats	10.3	27.3	14.1
Wild Oats	4.6	12.1	3.2
Ground Squirrels	3.4	9.1	38.0
Voles	4.6	12.1	100.0
Birds	2.3	6.1	10.0
Duck eggs	1.1	3.0	15.0
Miscellaneous insects	5.7	15.2	5.8
Carabidae	3.4	9.1	14.7
Diptera (pupae)	9.2	24.2	40.6
Mullusca	2.3	6.1	1.0
Vegetable debris	19.5	51.5	33.0
Cowhair	11.5	30.3	15.5

Vegetable debris comprised coarse sawdust, dead grass, and unidentified material.

Gull feathers (down) were found in four pellets.

Percentage frequency: The percentage of representation in a total of eighty-seven occurrences.

Percentage occurrence: Percentage of pellets in which the item occurred.

Average percentage volume: Volume for particular items.

Some of these pellets were fresh when collected, that is to say they had been regurgitated within an hour or so, others had been cast a day or several days earlier. Probably none were more than a week old because care was taken to select only the freshest appearing pellets. For example, most of those whose chief constituent was wheat were soft and wet when found. Subsequently these specimens dried out and became so hard it was difficult to break them.

The association of the pupal cases of Diptera with cowhair probably indicates a carrion origin for this insect food. The frequent occurrence of Carabid beetles with wheat suggests that the gulls had been feeding over stubble, or perhaps newly planted fields, where grain and beetles were picked up indiscriminately.

Wheat and oats were represented mainly by the outer layers of the kernels, the more soluble parts having been digested. These grains, more particularly wheat which was found in 57 per cent of the pellets and represented an average volume of 78 per cent, would appear to be an important food in spring and early summer. The probable sources are about grain elevators, along the railroad tracks and on summer fallow, all being localities which the gulls cover in their search for food.

FIG. 34. A Ring-billed Gull choked to death in attempting to swallow a Richardson's Ground Squirrel (left). Nest and seven eggs of the Ring-billed Gull (middle). Avocet's nest with five eggs and two downy young (right). Photographs by J. A. Munro, and loaned by courtesy of the National Parks of Canada.

Food of Downy Young. Two of five downy young collected for stomach analyses on June 2, 1934, contained food. These birds were thought to be approximately two days old.

No. 1. Insect fragments and eggs of a Dipterous insect, 60 per cent; vegetable debris including two *Carex* seeds, 40 per cent.

No. 2. Two damsel fly nymphs, eight Caddis adults, one Midge larva, 95 per cent; vegetable debris including one *Carex* seed, 5 per cent.

Relation with other bird species. Canada Goose, Mallard, Gadwall, Avocet, and Marbled Godwit were found nesting either on the island or close to it on the peninsula, the most numerous being the Avocet and the Canada Goose. These species were present in substantially the same numbers each year.

On June 19, 1932, on our way to the island we visited a colony of Avocets and found five nests with eggs and another in which two of eight eggs had hatched. The downy young were still in the nest. The nests were situated amongst sparse sedges at the outer edge of vegetation on the peninsula. Some were in the open and none were well concealed. The Avocets, associated in a flock, circled about us or flew up and down the beach. Several times they alighted on the shallow water and with head and neck bent downward paced along swinging their bills through the water with that curious side-wise motion characteristic of the species. On June 2, 1934, the colony numbered thirty-four birds which was approximately the same as it had been two years earlier. No evidence of molestation by gulls was observed.

A nest of Marbled Godwit with four eggs and a nest of Gadwall with six eggs both close to the nesting gulls had not been disturbed by them. Usually they nest amongst the willows or the thick vetches on the island proper.

The goose population comprises five or six pairs of breeding birds and about the same number of non-breeders. On May 26, 1933, after examining a nest containing egg shells which had been built in an opening amongst low willows, I discovered a second nest near the east shore. This one was a high substantial structure in the midst of the gull colony, some of the gulls' nests being within four or five feet. As I approached, the goose was seen standing with outstretched neck beside her nest partly concealed by some low vegetation. As I drew nearer she walked toward the water, a few rods distant, followed by three downy goslings just recently hatched. They launched out on

the water and proceeded toward a gander which was swimming back and forth a hundred yards or so from shore.

At this point I pictured in imagination an earlier scene: the goose on her high nest mound, in plain sight from every direction, settled on the eggs with a fluff of down showing along her flanks. Passing overhead and walking about close to her nest, dozens of gulls were her constant, noisy, and active associates. They built their nests within a few feet of the quiet goose. When she left her nest each day for food and water her five eggs were within easy reach of the gulls—a few quick stabs of the bill and all would have been destroyed—and they had survived intact.

But I noticed a fourth gosling, apparently a weak one, walking with uncertain steps far behind the others. It was transferred to the water and kept under observation while it swam toward the rest of the brood that, led by the goose, had reached a position close to the gander. When this fourth gosling was distant about forty yards from the shore a Ring-billed Gull picked it up and then, perhaps alarmed by my shouts, dropped it again. Later on when this downy was retrieved it was seen that its back had been broken. Meanwhile several other gulls had picked up and swallowed the three remaining goslings, while the two geese swam passively about making no attempt to defend their young. As this happened at a distance of at least 100 yards from where I stood it is considered that my presence on the scene probably was not responsible for the apathy of the parent geese.

Summary

A nesting colony of Ring-billed Gulls together with a few California Gulls situated on an island in Bittern Lake, Alberta, maintained a population of approximately 800 pairs during the nesting seasons of 1932, 1933, and 1934. A study of food remains on the island indicated a diet, for the months of May and June, of grain, ground squirrels, carrion, ground beetles, and mice, named in the order of their importance. Evidence of ducks' eggs being eaten was detected in one instance. Eggs, most of them unconcealed, in an adjacent colony of Avocets were not destroyed by gulls. A brood of four newly-hatched Canada Geese were eaten.

The data obtained are insufficient for definite conclusions regarding the local food habits of the species but are of sufficient interest to suggest that a detailed study is desirable.

Okanagan Landing, B. C.

FRANKLIN J. W. SCHMIDT

BY ALDO LEOPOLD

It is by now a truism that the American frontier did not cease to exist when the covered wagons halted on the shores of the Pacific. In its wake followed a scientific frontier, which opened up the resources of the new-found lands to human understanding in quite the same sense, and in no less degree, than the geographic frontier opened them to human occupancy.

It was quite a surprise to the gold-seeking Spaniards when James Ohio Pattie arrived in their midst, seeking not gold, but beavers. Just so is it now a surprise to biological scientists to discover as a fellow-explorer the conservation ecologist, seeking not new ways to squeeze wealth out of the soil, but ways to prevent the extraction of its wealth from destroying its wild life.

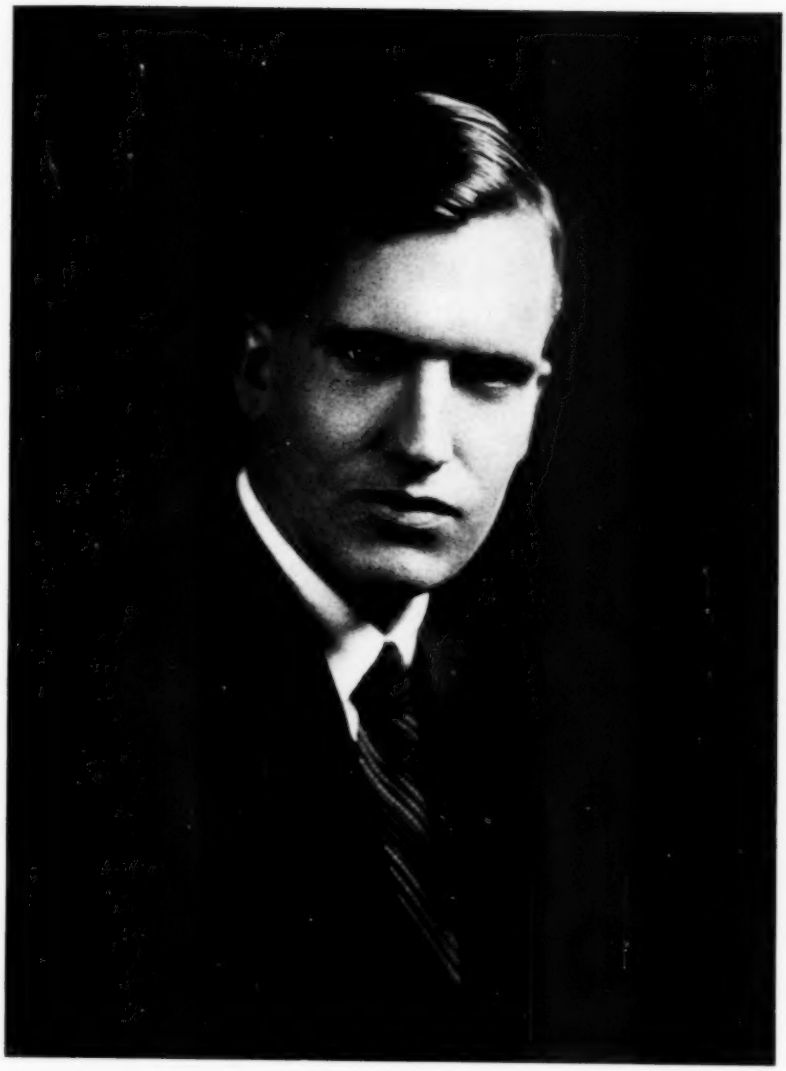
Society has not withheld its gratitude from the geographical adventurer who failed to come back, nor from the scientific explorer who dies in the course of an unfinished quest. It should, I think, at least know about important fatalities in that new argosy of the intellect which seeks not the conquest, but the preservation, of nature. Hence this biographical sketch of Franklin J. W. Schmidt, who, after five years' work in charge of the Wisconsin Prairie Chicken Investigation, died at Stanley, Wisconsin, August 7, 1935, in a midnight fire which also destroyed his accumulated notes, photographs, and manuscripts.

The philosophical questions involved in the death of a young explorer on the outbound trail are always of tragic interest. That Schmidt had seen virgin lands was well known to the more discerning of his research associates. That circumstances had unduly delayed publication of his findings is patent from the scarcity of his titles in the literature. (He spent his last evening on one of eight manuscripts to which, at the insistence of his friends, he had devoted the last months of his life). Whether he himself realized the full value of his findings, or whether their publication would have gained him widespread recognition, must remain forever among those questions which destiny thrusts unanswered into the stove. As his biographer I can only affirm the personal opinion, unsupported by those burned documents, and admittedly biased by the pain of a lost friendship, that Franklin Schmidt knew more about the life history and ecology of the prairie grouse than any living man, and as much as any living ecologist knows about any American game bird. Likewise that he had developed a deep understanding of the interactions of ecological forces, and the mechanisms of their integrated expression in the life and land-

scape of Wisconsin. It is no uncommon thing for a specialist to sound a record depth of knowledge in a single limited field, but it is a rare and inspiring thing to see one putting together a mental clock made of parts from the whole gamut of earth-sciences, and then listening for it to tick.

Schmidt's particular hobby was the marsh region of central Wisconsin—that waif of the slums of exploitation, long since cast out as an economic ne'er-do-well, but now the object of uplift by many conservation bureaus. If and when the intrinsic loveliness of those vast wastes is duly appreciated and restored, the mechanism of restoration will be set upon foundations of ecological understanding built in large part by Schmidt.

I vividly recall my first visit to the camp which each summer served as a base for his field studies in the central marsh region. In town or office Schmidt was ordinarily laconic, even taciturn. But as we roamed his beloved marsh, each bird and flower drew out of him new rivers of speech—the pent-up accumulation of years of lonely observation, speculation, and study. The sandhill cranes, their habits, personality, and probable history since the retreating glacier first left behind it the moss-meadows which are their habitat. His discovery that "red" cranes, like rusty snow geese, can be washed to their normal color, and hence represent no particular sex, age, or genetic strain. The burr oaks—how, why, and where they are an indicator of prairie, and the history revealed in their rings. The prairie chickens, how he had spied upon their mating dance, how his bandings reestablished Cook's assertion that only the hens migrate—how squeamish chickens are about roosts, and how by improving roosts we might help raise population levels. The dried-up hay marsh which once in the 1880's and again in 1913-16, was a lake from which the settlers trapped muskrats, how the existence of the former lake is indicated by the ice-ridge outlining its shore, and dated by the age of the trees growing out of that ridge. How in the intervening drouths this lake had been a hay-meadow, the present drouth representing simply the dry phase of a recurrent cycle. In short, no observed phenomenon was interpreted by Schmidt in terms of a short time or of a single scientific field. Its historical origin and its ramifications into a wide variety of fields were habitually followed out. In this difficult task Schmidt's woodsmanship, i. e., his ability to detect and interpret evidence invisible to ordinary men, played an outstanding part. He knew more than his fellow-workers because he saw more keenly and thought more deeply. I have seen few field naturalists of comparable skill and acumen.



FRANKLIN J. W. SCHMIDT, 1901-1935

We who teach how to use science for the ends of conservation are interested in the origins and education of such men, for there is always the remote hope of finding a clue to the puzzle of how to build them to order.

Franklin James White Schmidt was born at Lake Forest, Illinois, July 25, 1901. His parents were George W. Schmidt, Professor of German at Lake Forest College, and Margaret Patterson Schmidt. In 1907, when he was six years old, the family established a farm in Worden Township, Clark County, Wisconsin. There he grew up in an environment of forest and meadow well populated with wild things. His mother had a good knowledge of botany. His older brother, Karl P. Schmidt, had been imbued with an active interest in biology in the course of his studies under Dr. James G. Needham at Lake Forest College. His father had a deep and abiding interest in all wild things. With this guidance the boy developed an ever-widening proficiency in natural history. He trapped muskrats and mink. He raised ferrets, and his first published "research" was a letter on their habits embodied in Mrs. Anna Botsford Comstock's "Pet Book", in 1914.

Schmidt entered the University of Wisconsin in 1927. By this time he had decided on a career as field naturalist. He had been employed by the Field Museum in 1924, 1925, and 1926, and found congenial friends in Dr. W. H. Osgood and Mr. Colin Campbell Sanborn, and through them focused his interest on mammalogy. During his university years he spent the summers in collecting mammals, reptiles, and amphibians in his home county, publishing his notes on the mammals in the *Journal of Mammalogy* in 1931. Upon graduation from the University of Wisconsin in 1930, he was recommended by Prof. George Wagner as field assistant to Dr. Alfred O. Gross, who during that year initiated a study of the prairie chicken and the sharp-tailed grouse in Wisconsin. This field study now became his primary interest. After Dr. Gross returned to his duties in the East, the Conservation Commission placed Schmidt in charge.

In 1933 the project was discontinued for lack of funds. The newly established Chair of Game Management at the University of Wisconsin immediately offered Schmidt a fellowship for its continuation under university auspices. Schmidt had, however, already engaged to accompany the Mandel Expedition of the Field Museum to Guatemala. The fellowship was held open for him until his return.

Schmidt's field work in Guatemala was unusually successful. He collected and studied several new species of bats and rodents, and took

specimens of such rarieties as the bat *Centurio senex* and the Guatemalan flying squirrel.

Upon his return in 1934, he resumed work on the Prairie Chicken Investigation, focusing his efforts not only on the prospective completion of his doctorate thesis in about 1936, but also on the ultimate production of a monograph covering the life history and management of the prairie grouse in a manner similar to Stoddard's "Bobwhite". The plan was to center the work on Wisconsin until Schmidt's doctorate was completed, and then to set up a consulting service through which he would aid other states to get started in prairie grouse management, and at the same time have the opportunity to collect life history information from the whole continental range of the species. The first move to these ends was the completion of a series of eight papers summarizing the Wisconsin work to date. One of these papers had been completed at the time of Schmidt's death in 1935, and accompanies this biography. The other seven, in various stages of completion, together with most of the field notes on which they were based, were destroyed by the fire in which Schmidt met his death on August 7, 1935.

Other valuable unpublished material met the same fate. Schmidt had, for example, conducted annually for four or five years a rodent census on several sample areas. The population of rodents was accurately determined each year by trapping, marking, and releasing the animals until no unmarked individuals appeared at the traps. Schmidt hoped by this means to get accurate data on population cycles. The data from all areas save one were burned. The census on this one area has been continued by my students.

Few Wisconsin conservationists are aware that the first actual work in reflooding the drained marshes of central counties—a project on which the Resettlement Administration has since spent $150,000—was initiated by Schmidt. It came about in this manner: Schmidt was attending a somewhat convivial meeting of Milwaukee sportsmen. He asked the group to subscribe $100 to build one dam as a test or demonstration of the potential waterfowl breeding capacity of the drained marshes. They banteringly replied that they would give the money if Schmidt would drink a glass of whiskey. Knowing his abstemious habits, they thought this a safe reply. But Schmidt promptly gulped the whiskey, and within a few weeks the dam was built and had ducks in it.

Schmidt's death is the first fatality in that young profession known as wildlife management. He has set for that profession a high stand-

ard of devotion, modesty, skill, and thoroughness. It will be no small task for those who survive him to live even partially up to his mark.

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UNIVERSITY OF WISCONSIN,
MADISON, WIS.

WINTER FOOD OF THE SHARP-TAILED GROUSE AND PINNATED GROUSE IN WISCONSIN

BY F. J. W. SCHMIDT

INTRODUCTION

The present paper is the first of a series summarizing the findings of the Wisconsin Grouse Investigation since 1930.

A research bureau of the Wisconsin Conservation Department was organized in 1928 by Wallace B. Grange and Dr. Merritt L. Jones to begin a study of the Prairie Chicken and the Sharp-tailed Grouse. Its findings up to 1930 were published in the "Progress Report of the Wisconsin Prairie Chicken Investigation" by Dr. Alfred O. Gross.

I took over the study during the winter of 1930-1931, which was spent observing the feeding habits of grouse at grain food patches and feeding stations. In March 131 sharptails were banded. Since then 550 Sharp-tailed Grouse and 275 Prairie Chickens have been banded. Studies of nests were made during the springs of 1931, 1932, 1933, and 1934. Moving pictures were made of Sharp-tailed Grouse and Prairie Chickens on their dance grounds. Dance ground flocks were counted through a series of successive years. During the summer of 1932 Prairie Chickens were raised at the state game farm. During the summer of 1934 the food habits of Marsh Hawks and Cooper's Hawks were studied in their relation to grouse. During open seasons grouse crops and stomachs were collected and sex counts were made from hunters' bags. The investigation was discontinued in January, 1933, and resumed in May, 1934, as a game management project at the University of Wisconsin under the direction of Aldo Leopold.

The term "grouse" is here used for Prairie Chickens, Sharp-tailed Grouse, and Ruffed Grouse collectively, unless otherwise stated.

ACKNOWLEDGMENTS

Grateful acknowledgment of assistance is expressed to Aldo Leopold, Professor of Game Management at the University of Wisconsin; to George Wagner, Professor of Zoology at the University of Wisconsin; to H. W. MacKenzie, Director, Wisconsin Conservation Department; to William F. Grimmer, Wisconsin Conservation Department; to Dr. Merritt L. Jones of Wausau, Wisconsin; to W. L. McAtee and Charles C. Sperry of the U. S. Bureau of Biological Survey; and to E. R. Van Wormer, Babcock, Wisconsin.

SCOPE

The present paper deals with winter food only. It is based on observations at winter feeding stations and grain food patches; on observations of migrant Prairie Chickens on their wintering grounds; on observations of grouse budding in trees; on observations made by back-tracking flushed grouse; on artificial feeding of grouse in pens; and on the crop contents of nineteen grouse collected during the winter. A larger series of winter crops and gizzards is being collected for a report on the percentage of the various foods eaten. In addition, a large series of summer and fall crops have been collected, but are not here reported.

The dietaries of the Sharp-tailed Grouse and the Prairie Chicken overlap, but are nevertheless essentially different, the sharptail being a northern bird extending into Wisconsin from the northwest, while the Prairie Chicken is a more southern bird extending into Wisconsin from the south. Originally the chicken was probably mainly a migrant. It became a permanent resident when a new food supply was introduced by agriculture. The winter food habits of the two species are here discussed separately, from the standpoint of grouse management, with special reference to the question of how much if any grain and cultivated weed seed is necessary, and at what seasons.

THE PRAIRIE SHARP-TAILED GROUSE (*Pedioecetes phasianellus campestris*)

The following winter foods are grouped according to the length of time during which they are usually available.

Browse is available throughout the winter, and is the most important class of winter food. Wisconsin sharptails browse on the buds, catkins, and twigs of white birch, aspen, balsam, poplar, willow, bog birch, and leather-leaf. All these may be regarded as staple winter

foods. The kind of browse eaten depends somewhat, of course, on the kinds available in any given area.

Climbing Plants. The seeds of climbing false buckwheat (*Polygonum dumetorum*) are, while they last, always held above the snow. It has been determined by observation and by tracking that sharptails feed on the seed of this plant.

Grain. To understand the rôle of grain in the grouse dietary, it is necessary to hark back to the day when all grouse lived without it. At the present time there are still sharptails inhabiting grainless range, whereas all Prairie Chickens now know and use grain to some extent. Few Ruffed Grouse as yet know or use grain.

Grain is available in fall, but tends to become exhausted or covered during winter. The only exception is shocked corn. In November and December, when the ground is bare, sharptails gather in packs of from twenty to several hundred to feed on harvested fields of oats, buckwheat, soy beans, and corn. Buckwheat seems to be preferred, yet the biggest pack I have ever seen was one of more than 400 birds on an oat field at Hawkins in Rusk County. The cultivated grains mentioned above may be classified as preferred fall foods for those sharptails which know and have access to them.

All sharptails, in winter, tend to revert to a diet of browse. The details of this change are discussed later.

At the time Leopold (1933, p. 261) was preparing a table of the palatability sequence of winter foods, I classified corn as an emergency food for sharptails. At that time the existence of grainless sharptails, and the general winter preference for buds, was not understood. Corn should now be classified with the other grains as a preferred fall food.

The peculiarities of sharptails in relation to artificial feeding of grain are covered in detail later.

Seeds, Berries, and Leaves. These foods are available when not covered by snow. Sharptails do not feed on weed seeds as extensively as Prairie Chickens do. When snow does not cover the ground, sharptails eat the seeds of smartweed (*Polygonum pennsylvanicum* and *Polygonum hydropiper*), the berries of wintergreen (*Gaultheria procumbens*), snowberry (*Symphoricarpos albus*), and cranberry, and the leaves of white, red, and alsike clovers, sweet clover, alfalfa, goldenrod, strawberries, and sheep sorrel. These greens and fruits may be classified as "tonic, mineral, or vitamin foods" (Leopold, 1933, p. 268). The available variety of these foods is of course much smaller in winter than in summer. With the exception of sheep sorrel they

are eaten in small quantity. Sheep sorrel, until snowed under, is taken in large amounts when sufficiently abundant.

Red Grouse and Sharptail Compared

It is interesting to note that the Red Grouse of England and Scotland and the Sharp-tailed Grouse have eight foods in common. The following Red Grouse foods taken from "The Grouse in Health and Disease" (pp. 76, 83, 85) are also eaten by Wisconsin sharptails:

1. *Vaccinium* sp. blaeberry, blue whortleberry, blueberry. The stem, leaves, flowers, and berries are eaten.
2. *Vaccinium oxycoccos*, bog cranberry. The leaves and berries are eaten.
3. *Arctostaphylos uva-ursi*, red bearberry.
4. *Salix* sp., willow. The leaves and shoots are eaten. In the summer the willow furnishes food in the form of galls.
5. *Myrica gale* and *Myrica asplenifolium*, sweet gale, sweet fern. The buds and catkins are eaten.
6. *Rumex acetosella*, sheep sorrel. The seeds are eaten by Red Grouse and the leaves by sharptails.
7. *Betula* sp., birch. Chapman, p. 25, states that Red Grouse feed on birch, but he does not state what kind of birch.
8. *Polygonum aviculare* and *Polygonum persicaria*, smartweed. The seeds are eaten by both species.

Sharptail Food in Other Regions

Below are a few references to the winter food of sharptails in regions north and west of Wisconsin.

Judd (1905, p. 22) lists the leaves of cottonwood, alder, blueberry, juniper, and larch (tamarack) as foods of the sharptail. It is probable that they also feed on the buds of these plants during the winter. Judd also quotes Hearne as saying that sharptails in winter feed on the tops of dwarf birch, and on poplar buds. Otherwise he does not distinguish between winter foods and foods eaten at other seasons.

Coues (1874, p. 418) refers to the winter food of the sharptail along the Missouri River as follows: "Killed under these circumstances, the food of the Grouse is readily ascertained; in the dead of winter it consists chiefly of the berries of the cedar, and buds of the poplar or cottonwood and willow, still closely sealed awaiting the coming of spring."

Bendire (1892, pp. 102-103) quotes a letter from George Bird Grinnell as follows:

"The Sharp-tailed Grouse, which in certain sections is called 'Speckled Belly' and 'Willow' Grouse, I have found in various years almost everywhere west of the Mississippi River, east of the Sierra Nevadas, and north of the Platte River. In the old days it used to be very common all along the Platte and the Loup Rivers in Nebraska, and in the country which lies between these two streams. I have also found it nearly as abundant in the mountains, sometimes even late in the autumn, coming upon single birds or a considerable brood, far up toward the edge of timber in the most narrow wooded ravines. This species is partly migratory, and there is the very greatest difference in the habits of the bird in summer and winter. As soon as the first hard frosts come in the autumn the birds seem to take to the timber, and begin to feed on the buds of the willow and the quaking aspen. At this time they spend a large portion of their time in the trees and are very wild. In the Shirley Basin, in western Wyoming, a locality where I have never seen any of these birds in summer, they are abundant in winter. At this season they live in quaking aspen thickets along the mountains, and there I have seen hundreds of them roosting on top of a big barn which stands just at the edge of a grove of quaking aspen timber."

Dery (1933, p. 4-7) found ironwood (*Ostrya virginiana*) and mountain ash to be the most important foods of the migrating northern sharptails in Quebec. The buds and catkins of ironwood were found in nineteen stomachs and varied from 8 per cent to 98 per cent, averaging 61 per cent of the total food. Mountain ash berries and buds varied from a trace to 71 per cent, averaging 26 per cent. Other winter foods were birch buds and catkins, aspen buds, cherry buds, alder catkins, willow buds, rose hips, seeds of *Viburnum opulus* and *Cornus canadensis*, *Rubus* sp., hazel buds, *Aralia hispida*, *Cornus paniculata*, tamarack buds and twigs, and *Unifolium canadense*.

As the foods in Dery's list were determined from the northern sharptails which appeared in Quebec in 1932, it is possible that they may be different from those eaten by this subspecies on regular winter range.

Bent (1932, p. 286) lists the buds and sprouts of *Betula glandulosa*, willow, aspen, and larch, and the buds of juniper as food of the northern sharptail. Presumably he means winter food.

Bendire (p. 104) thinks that in Manitoba rose hips are eaten as grit. He quotes Ernest E. Thompson (Ernest Thompson Seton) as follows: "To illustrate the importance of this shrub (prairie rose) . . . I append a table of . . . the contents of crops and gizzards of Grouse killed during various months:

January—Rose-hips, browse, and *Equisetum* tops.
February—Rose-hips and browse.
March—Rose-hips and browse.
April—Rose-hips and browse of birch and willow.
November—Rose-hips, birch and willow browse, and berries of arbutus.
December—Rose-hips, juniper berries, and browse.

"This is of course a mere list of staples, as in reality nothing of the nature of grain, fruit, leaves, or insects comes amiss to this nearly omnivorous bird, but it illustrates the importance of the rose-hips, which are always obtainable, as they grow everywhere, and do not fall when ripe."

Grinnell, Bryant, and Storer (1918, p. 563) say of the Sharp-tailed Grouse (all races): "Especially during the winter when other kinds of food are difficult to procure do these birds feed rather extensively on buds and leaves. . . . The wild rose supplies the Sharp-tail with about 17 per cent of its fruit food, the stony-seeded hips being taken in great quantity; in places where gravel is lacking these seeds seem to serve for grinding other materials in the stomach."

Dery (pp. 4-7) reports rose hips in eleven of nineteen stomachs. The amount varied from a trace to 21 per cent of the stomach contents.

In Wisconsin, possibly due to a good supply of grit, rose hips are not very extensively eaten.

Errington (1931, p. 8) has shown by feeding experiments that rose hips are low in nutrition value for quail and this may also be true for grouse. It is possible, however, that they may digest them more efficiently than quail do.

According to observations made on Red Grouse (*The Grouse in Health and in Disease*, p. 99), fruit stones are poor substitutes for gravel and may cause more harm than good. When thornapple stones were eaten the gizzard was found to be unable to retain the more useful quartz, and when this happened at a time of grit shortage, the Red Grouse was unable efficiently to digest browse.

We can conclude either that the sharptail is better adapted than the Red Grouse to grind browse with only rose or thornapple stones as grit, or that the American authors above quoted have over-rated fruit stones as an effective substitute for mineral grits.

In general, the principal differences in the winter diet between Wisconsin and other sharptails are the heavier consumption of willow buds in other regions, and the inclusion of certain foods not available in Wisconsin, such as juniper buds and berries, mountain ash buds and berries, ironwood buds, and cottonwood buds.

Artificial Feeding of Grain

Experiments have been conducted to determine the amount of grain that may be eaten and the best methods of feeding it.

Buckwheat food patches were planted in central and northern counties. They were used in fall, but not after the first snow.

It was found that sharptails did not know how to eat corn from shocks, but learned the trick from Prairie Chickens when the two occurred in the same flock. Sharptails have been observed feeding with Prairie Chickens on shocked corn in Wood, Portage, Adams, Washburn, and Burnett Counties. Corn, however, was not found to be an important item in the diet of the sharptail, as very little corn is raised in northern Wisconsin.

Numerous experiments were made on hopper feeding. Sharptails learned almost at once to eat buckwheat from hoppers and would go under shelters to feed. Shelled corn, wheat, rye, and oats fed in adjacent hoppers were not eaten. Sharptails did not at first recognize ear corn as a food. They gradually learned to feed on husked ears placed on the ground where they were feeding on buckwheat. Later they even learned to strip the husks from ears. Once they knew how to eat ear corn, they would fly up to platforms where ear corn was stuck on spikes. This system was first used to feed Prairie Chickens (see Figs. 36-37).

In Juneau and Wood Counties where sharptails were fed for the purpose of banding, it was found that approximately 2,000 birds ate 3,000 pounds of buckwheat and 1,000 pounds of corn, or two pounds of grain per bird per month. The cost of the grain amounted to only four cents per bird per month, but labor and equipment brought the total cost to fifty cents per bird per season.

Evidence that Winter Grain Is Unnecessary

Ignoring of Food Patches. As evidence that winter grain is not necessary for sharptails, Mr. E. R. Van Wormer of Babcock informs me that even when stacks of buckwheat were opened up in a food patch located right in a budding area, only a few of the birds which had fed in the patch during November made their appearance there as long as there was snow. After the snow had melted in March, the birds returned to feed on the buckwheat.

Another instance: In northern Juneau County a flock of ten cocks and eleven hens fed in a patch of buckwheat until the advent of snow about December 1, when they changed to a bud diet. Buckwheat shocks and a hopper filled with buckwheat, together with corn shocks and ear corn, were placed in the food patch. Apparently they no

FIG. 36. Prairie Chickens feeding on ear corn stuck in snow and on ear corn held in woven wire container. Photograph was taken from a blind built of snow.

FIG. 37. Prairie Chickens feeding on ear corn impaled on spikes and stuck in the snow.

longer recognized the food patch as a source of food, although buckwheat shocks were in plain sight of the white birches on which they budded and only 100 yards away. Neither did they think of visiting the food patch to see if any grain were available. On January 18 grain was strung along on top of the snow from the birch trees on which they budded to the feeding station. They followed the path of grain and located the grain in the hopper and in the shocks. They continued to feed at the hopper until spring. It does not necessarily follow that they needed this grain, for they had been getting along very well without it.

I conclude that sharptails use food patches in fall until the first snow of winter, and again in the spring, but not during the winter budding season. Additional winter grain appears not only to be unnecessary, but may be ignored by the birds unless literally "thrust under their noses". Prairie Chickens, on the other hand, seek out grain even during the budding season.

Changes in sharptail population levels are brought about by causes other than available winter grain and deep snow. This seems to be positive evidence that winter grain is unnecessary for survival and increase. Thus in northern Wisconsin where not more than 10 per cent of the sharptails were within reach of winter grain, and where the snow was deep, there was an increase during the summer of 1933, the license reports indicating a larger kill than in 1932.

It might be mentioned as negative evidence that during the summer of 1933 there was a big drop in the number of sharptails in Wood and Juneau Counties. This drop in numbers followed a nearly snowless winter and two winters of extensive feeding of grain by means of hoppers.

Bud Feeding Experiments. Two captive sharptails were fed on white birch and willow buds only. One lost five ounces in two weeks, while the other lost three ounces in the same time. A third sharptail fed on mixed grains and buds lost three and one-half ounces in the same time. As the control lost weight at about the same rate as the two birds fed on buds only, it is probable that the loss of weight was due to being in a pen, and not to the diet.

Feeding experiments should be conducted with more birds and over a longer period. At present there is no reason to doubt the ability of the sharptail to keep in good condition for several months on a browse diet.

Management

Winter feeding of grain is not recommended for sharptails, but where Prairie Chickens are being fed there is, of course, no harm in feeding both.

There can be no doubt, however, that the availability of grain in fall increases the carrying capacity of sharptail range during the pre-budding season. Food patches of buckwheat, standing corn, oats, and soy beans are especially needed in wild regions where there are no farms, and hence few weeds and no grain. In farmed regions farmers should be encouraged to raise more buckwheat. A harvested buckwheat field is an excellent source of early winter grain, provided it is not fall-plowed. Farmers might, if offered share-cropping privileges, be willing to plant buckwheat on wild state land several miles from their farms, just as they now go five to thirty miles to make hay in a hay marsh. On the Upper Mississippi Wild Life and Fish Refuge farmers are given permits to cut marsh hay, and also land on which to raise corn on a share basis. The farmer gets free hay "stumpage" and part of the grain; the government gets the remaining grain for feeding purposes without cash outlay.

Reflooding of drained marshes unfit for agriculture will be beneficial to the winter food supply of sharptails. Such flooding is now under way in Juneau, Jackson, and Wood Counties. White birch will become abundant on all wet borders without artificial planting. A growth of white birch, bog birch, and white pine has already taken place on the borders of flooded areas belonging to cranberry growers in Wood, Jackson, and Monroe counties. If hay marshes are developed on flooded areas, bog birch will come in around the edges of the hay land. The importance of hay marshes will be more fully explained in a paper on grouse range.

Budding grouse of all species prefer trees that are at the edge of a thicket, standing alone, or in small groups. A dense stand of white birch or aspen is of little use as a bud supply except for a few trees around the edge. It is not known whether the buds are larger or better on trees in the open, but it is apparent that a stocky, bushy tree has more buds and is easier to climb around on than a slim tree in a dense thicket. Budding trees which meet these specifications can be provided either by planting isolated trees, or by thinning thickets which are too dense, either by cutting or pasturing.

On some of the drained marshes of Portage County, where the farms are large and have many small patches of aspen, budding grounds are very good. This is especially true of the region west of

Bancroft. Farmers generally should encourage small patches of aspen and white birch in treeless areas. Why not leave a patch of fast growing aspen to grow stove wood and to feed grouse at the same time?

The Greater Prairie Chicken or Pinnated Grouse

(*Tympanuchus cupido americanus*)

Browse. At first it was believed that Prairie Chickens did not bud to any extent in Wisconsin, but more recent observations indicate that Prairie Chickens feed on buds and catkins all through the winter. They differ from sharptails first in that the hens migrate in winter to the southerly counties, where they have ready access to both corn and buds. Second, they differ in that the wintering cocks which remain in the north seek out grain and weed foods, whereas sharptails do not. I have evidence proving that the wintering cocks can subsist on browse plus a small amount of weed seed. A flock at Swamp Lake, Oneida County, wintered on browse, no grain, and very little weed seed.

There are not many records of Prairie Chickens feeding on buds. Judd (p. 18) says: "Naturally the prairie hen is much less given to budding than the ruffed grouse, but it has been known to pluck buds of poplar, elm, pine, apple, dwarf birch (*Betula glandulosa*), and black birch (*B. lenta*)." In Wisconsin chickens browse mostly on the buds and catkins of white birch, bog birch, hazel, and aspen. This applies to both hens and cocks.

Grain and Seeds. The hen chickens, having repaired to the southern counties and mixed with the resident birds of both sexes, feed with them on weed seeds and small grains until about December 1, after which they begin eating corn. I have not yet found out just when buds become a large item in the dietary, but I know they are taken regularly as soon as regular corn-eating begins. The food of cocks remaining in the north is similar, except, as already stated, there may be no corn.

Of the weed seeds eaten, the most common are ragweed (*Ambrosia artemisiifolia*), sedge (*Carex intumescens*), green foxtail (*Chaetochloa viridis*), lamb's quarters (*Chenopodium album*), barnyard grass (*Echinochloa crusgalli*), smartweed (*Polygonum pennsylvanicum*), common smartweed (*Polygonum hydropiper*), climbing false buckwheat (*Polygonum dumetorum*), black bindweed (*Polygonum convolvulus*), and knotweed (*Polygonum cilinode*). Ragweed and climbing false buckwheat form a regular part of the diet whenever available, while the other weeds are eaten only occasionally.

Leaves. Leaves and greens are eaten regularly in summer and fall, and in winter when not snow-covered. The green leaves eaten include willow, clover, alfalfa, sweet clover, sheep sorrel (*Rumex acetosella*), goldenrod, wild strawberries, and other leaves that remain green all winter. A considerable amount of green hay is eaten when the hay is hauled out of the marshes during the winter. In February it was found that pieces of green grass were present in Prairie Chicken droppings, although due to deep snow there was no green grass available. The mystery was cleared up when the source was found to be green hay picked up on stack bottoms.

Wintering Grounds. Food determines what range is habitable in winter, but so does cover, particularly roost cover. The sexes seem to differ as to the kinds of both food and cover needed, and this may account for the fact that the hens but not the cocks migrate. Migration and cover will be discussed in separate papers. I am here considering only the food needed for winter range.

The male Prairie Chickens winter a few miles of their booming grounds, and seek whatever grain is available, not necessarily corn. Thus in Burnett County a flock of thirty cocks fed on soybeans when there was no snow. When the snow was deep they picked grain from straw stacks and from the manure and straw that the farmers spread on the snow. There seems to be a definite correlation between wintering cocks and farms even if there is no grain. Perhaps the weed seeds, however scarce, that occur on farms, are enough to supplement buds. On the other hand, the sharptails on the winter cock range are found as far away from farms in winter as in summer.

The hen chickens which travel southward apparently move until they find a combination of food and cover that suits them. For the upper Mississippi Valley this winter food requirement may at present be said to be corn and buds. At least they seem to migrate far enough to reach bountiful corn and buds, and there they stop.

Cooke (1888, p. 105) tells of the migration of hens into Iowa. Leopold (1931, p. 174) shows this movement still persists, and must come from Minnesota because there are virtually no nesting birds in Iowa. The distance hen chickens move is therefore several hundred miles.

In Wisconsin, however, a shorter movement seems to answer the purpose. The accompanying map, derived from banding records, indicates that the northern Wisconsin hens winter in the southern half of the state.

More chickens in summer than in winter. Winter population mostly cocks. Winter sex count at five stations shows 121 cocks to 16 hens.
More chickens in winter than in summer. Winter population consists of local breeders plus migrant hens. Winter sex count at three stations shows 49 cocks to 272 hens.

FIG. 38. In winter the range north of the horizontal line holds mostly cocks. Range south of the line holds a resident population plus the northern hens.. Dots show banding stations, and which sex predominates in the winter-caught chickens at each station.

I suspect that a wintering ground, to be acceptable, must offer certain essential elements. I tried to analyze this by comparing the composition of two typical wintering grounds: O'Brien County, Iowa, and Adams County, Wisconsin. In Iowa there is about ten times as much unhusked and shocked corn as there is roost, while in Wisconsin the opposite is true. In Wisconsin Prairie Chickens live almost entirely on buds when the temperature is above zero, but eat, and probably need, corn when it is below zero. In Iowa corn is eaten regularly and clover is eaten as a substitute for buds when it is not covered by snow. Chickens migrate to northern Iowa in the fall and may resume migration in midwinter. Resumption of migration southward across Iowa on snowy winters when there is no shortage of available corn is probably due to a shortage of roosting places, a shortage of buds, and snow covering the clover. In Wisconsin where good roost grounds and plenty of buds are available, there is no migration during the winter no matter how much it snows. What migration there is occurs in late fall.

It is therefore probable that corn, roosts, and buds, or a substitute for buds such as available clover leaves, may be the essential elements and that the low percentage of roost and buds in Iowa is tolerated only because of an abundance of corn and only when clover leaves are available. If this is correct, it would follow that the Iowa range could be strengthened by more roost and buds, and the Wisconsin range by more corn.

Hen Prairie Chickens prefer shocked corn to small patches of standing corn. Thus in Adams County a farmer left out one acre of standing corn next to a field of shocked corn. Chickens refused to feed in the standing corn as long as there were shocks. In Iowa standing corn is preferred because it is in large fields and the stalks are constantly being broken down by cattle so that the ears can be reached by the birds. In February, 1935, several hundred were feeding in a 25-acre field of unhusked standing corn at Trempealeau, Wisconsin. The farmer stated that ordinarily there is no unhusked standing corn in the vicinity. This year it was left because deep snow halted husking. It was noted that the chickens fed almost exclusively in the northwest corner of the field where the stalks were bent over or broken by the northwest blizzards.

Hen Prairie Chickens wintering in eastern Wisconsin on the Wolf River and Lake Poygan marshes feed on shocked corn and on the grain and seeds in the manure which is spread on the snow.

Range Extension. Increase in Prairie Chicken population and an extension of range resulted from the extensive growing of corn by the early settlers. This indicates that corn replaced some other staple food eaten in pre-settlement days which could be obtained by migration from the summer range. I suspect that this may have been acorns or some legume. The exact winter range of the Prairie Chicken is not known, but it was probably Oklahoma, Texas, Arkansas, Missouri, southern Illinois, and eastern Kansas. Judd (p. 12) quotes Audubon as saying that chickens were abundant in winter at Henderson, Kentucky, in 1810. These were probably local birds plus winter migrants from Ohio. The fact that the birds came into the streets and farm-yards indicates that Kentucky did not have a good supply of natural winter food and perhaps was not original winter range.

The increase in population is best noted in Illinois. Judd (p. 12) quotes Hatch as saying that as late as 1836 a hunter was lucky to bag a dozen in a day. Bogardus (1874, p. 66) states that he and another hunter killed 600 in ten days in McLean County, Illinois, in 1872. Bogardus (p. 87) states further that in Logan County native chickens were abundant in 1860, but by 1874 the main shooting was on fall migrants from counties to the north where unbroken prairie suitable for nesting was still abundant.

Leopold (1931, p. 165) speculates that the Indians did not leave enough corn out to give the chickens a chance to learn to eat it.

In Wisconsin chickens followed settlement until now they have reached Lake Superior. In certain central counties they are still extending their range. Thus they became established in northern Clark and southwestern Taylor Counties as recently as 1928.

Gross (1931, p. 28) quotes Spurrell as observing that after 1880 "corn became a common crop [in Sac County, Iowa] and birds wintered as well as nested abundantly", whereas previously there had been a marked migration.

Management

Grain. Corn, preferably shocked, should be provided wherever not already available. Food patches of other small grains and harvested fields of buckwheat and soybeans are valuable supplements to corn when there is no snow, but should not be relied upon as the chief source of winter grain in regions of heavy snowfall.

Feeding stations may also be used to furnish winter grain to chickens. Ear corn may be impaled on sharp sticks that may be set upright in the snow. This system was used by John Worden of Plainfield as early as 1928.

A similar device consists of two parallel boards, one with spikes to stick the corn on, and one for the birds to sit on, erected as a rough table high enough above the ground to be rabbit-proof.

Poles with spikes work equally well. The poles should be three feet above the ground, six or eight inches apart, and every other pole should be without spikes. Where two-inch poles are available, the only cost for such a feeding station would be ten cents' worth of spikes.

Ear corn may be tied in strings with bindertwine and tied around a cornshock. This system works well but is more work than the spike system. Ear corn may also be fed in a wire cylinder from which the corn may be worked out as it is eaten (see Fig. 36). Prairie Chickens do not like to eat grain from a hopper, as they dislike to enter the shelter necessary to protect the hopper from rain and snow. Hoppers for this reason are not recommended.

All Prairie Chicken feeders should be placed in the middle of a field, as Prairie Chickens like to feed where they can see in every direction (see Figs. 36-37).

Browse. If browse for chickens needs improvement, the following differences in browse requirements of Wisconsin grouse should be noted. Browse requirements of Prairie Chickens and Sharp-tailed Grouse are approximately the same except that chickens do not feed on leatherleaf and sharptails do not feed on hazel. Both differ from Ruffed Grouse in that they do not browse on alder to any extent. Ruffed Grouse, like Prairie Chickens, are very fond of hazel catkins. These differences may be due to availability, which depends on the type of range inhabited by the different species of grouse, and not to a difference in palatability. For Prairie Chickens the buds and catkins of white birch, bog birch, hazel, and aspen are important staple foods and an abundance of these plants greatly improves the winter food supply. They may be in hedges or scattered in pastures. Hazel hedges are especially recommended. As snow drifts into the hedge, more and more of the catkins become available to browsing chickens and other grouse.

Summary

The table of grouse foods given below corresponds to that given by Leopold (1933, p. 261) except that the subspecies of sharptails are distinguished from each other and Ruffed Grouse is added for comparison. For definitions of the various classes of winter feed see Leopold (1933, p. 259).

TABLE 1. Palatability Sequence of Winter Foods.

CLASS	SPECIES AND EXAMPLES OF FOOD IN EACH CLASS			
	PRAIRIE SHARP-TAILED GROUSE (Gross, Coues, Schmidt, Bendire) Wis., Nebraska, Dakotas	NORTHERN SHARP-TAILED GROUSE (Dery, Bent) Quebec	PINNATED GROUSE (Gross, Schmidt, Judd) Wisconsin, Iowa	RUFFED GROUSE (Schmidt) Wisconsin
Preferred Foods (eaten mostly before snow)	Buckwheat Corn Soy beans Oats Sheep sorrel Acorns Clover leaves	?	Buckwheat Soy beans Barley Oats Ragweed Smartweed Acorns Rye Climbing false buckwheat	Clover leaves Strawberry leaves Acorns Mountain ash berries
Staple Foods (eaten mostly after first snow)	White birch buds* Bog birch buds Aspen buds Leatherleaf leaves and buds Willow buds Cedar berries Cottonwood buds	Ironwood buds (*Ostrya virginiana*) Mountain ash berries Aspen buds Willow buds Juniper buds	Corn Hazel buds White birch buds Bog birch buds Aspen buds Black birch buds	Aspen buds White birch buds Hazel buds Willow buds Alder buds
Emergency Foods	Blueberry buds Pincherry buds Climbing false buckwheat Tamarack buds Alder buds	White birch buds Cherry buds Tamarack buds Alder buds	Maple buds Elm buds Willow buds Pine buds Apple buds	
Mineral Tonic Vitamin	Green leaves Rose hips Sweet fern buds Weed seeds Berries	*Rubus* Rose hips *Aralia* Berries	Various weed seeds Rose hips Hay Sorghum seeds Mullein seeds Green leaves	Sweet fern buds Sumac berries Rose hips Corn
Grit	Gravel Rose stones	Gravel Rose stones	Gravel Rose stones	Gravel Rose stones Cherry stones

*In this table buds include catkins and twigs.

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THE FIRST DESCRIPTIONS OF NORTH AMERICAN BIRDS

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Many a biologist has longed for the opportunity to examine the fauna and flora of some land never before visited by a naturalist. Few have had that opportunity, and usually the information on a new country has accumulated over a period of time, through uncertain channels, much of it poorly collected and poorly preserved. Here in America we particularly wonder what birds the first Europeans noted and what they thought of them. The Baltimore Oriole and the Yellow Warbler were the first ones mentioned by Maximilian when he landed at Boston, but that was in 1833, more than 300 years after the arrival of the first explorers. One can hardly doubt that these two species were among the first to be observed by others. Christy (*Auk*, 50:275-283) found the Sandhill Crane, Flicker, Blue Jay, Bluebird, Red-winged Blackbird and Towhee in what he believed to be the earliest written account of American birds (in 1613 or 1614). This writer presumably had not visited America but may have talked with someone who had been there and must have seen specimens which had been brought back. Still more recently, Mrs. Allen has described some paintings (*Auk*, 53:17-21) made about 1585, which included a Tropic Bird, Brown Pelican, Booby, Flamingo, Noddy Tern, and Flicker.

It is a simple matter to tabulate from the A. O. U. Check-List the various authors and the dates at which their names were given to the birds, but this yields a number of instances of common birds described later than 1900. In fact, if we list all subspecies, we have a very considerable number of recently discovered birds. This naturally suggests the advisability of limiting the discussion to the larger unit and

disregarding the subspecies. The early writers had no conception of our present subspecies, though they often described American birds as varieties of Old World species, and not infrequently they described two or more "species" from what we now know as different plumages of the same bird. In justice to recent authors it should be mentioned that some forms which had long been regarded as distinct species have been reduced to subspecies, and that a great many of the current subspecies have at some time been given specific rank.

In many cases the Check-List names are not the oldest. The Lark Bunting is known by a name given by Stejneger in 1885, but it was first described by Townsend in 1839 and known under his name until it was changed because of the still earlier use of Townsend's specific name for a different bird. Our common Crow passed for many years under the name given it by Audubon in 1834. Then an earlier name used in 1822 by a German writer, Brehm, was found applicable. Wilson had fully described the Crow in 1811 but considered it the same as the Carrion Crow of Europe. Shall we say that he was the first to describe the American bird? Certainly such a species could not fail to attract attention, but no earlier name appears in the usual literature excepting one by Bartram in 1790. Bartram's names were not consistently binominal, and all of them are rejected by most ornithologists. Few of the later descriptions were based upon his.

The use of the earliest name for the species as a whole results in a few complications. In a number of cases, such as those of the Raven, Magpie, Brown Creeper, and Crossbill, the American birds are considered races of a species which also has European races. In such cases the "species" was first discovered and described in the Old World. It might seem that we should credit the first author who described the American form as different from that of the Old World, but that would again involve the matter of the subspecies and in any case we can hardly disregard an author who gave a good description of the American bird without recognizing such difference.

The first races of many of our birds were described from Mexico, Central America, the West Indies, or South America. Quite a number of the tropical birds, or at least certain of their representatives, reach the southern borders of the United States. I find no less than 105 species of which the first form to be described does not occur within our limits. Some of the birds of eastern Asia occur more or less regularly on the Alaskan coast. In the present study I have omitted those which have been introduced from other regions or which are of only accidental occurrence in North America north of Mexico. There is of

course no sharp natural definition of the limits thus set up. Another difficulty, and one which has been very puzzling in the matter of nomenclature, is the fact that many of the early descriptions were based upon more than one still earlier description and frequently included more than one species.

The following list of the number of species described by each author, I have compiled by using the earliest identifiable name as given by Ridgway ("Birds of North and Middle America") for the oldest form of each species of the A. O. U. Check-List (4th ed.), excluding introduced and accidental species. Since Ridgway had not treated a number of families, including the bitterns, ducks, and hawks, I could not deal with these in a quite similar manner. Peters' "Check-List of Birds of the World" (Vols. 1 and 2) has been especially useful on those groups, and the historical chapter of Coues ("Key to North American Birds") has been helpful in many ways. So many difficulties and problems of treatment are involved that the list must be considered as only approximately correct.

SPECIES OF NORTH AMERICAN BIRDS DESCRIBED BY DIFFERENT AUTHORS

Linnaeus, 10th ed. (1758)		
Occurring also in Europe	65	
Based upon Catesby	59	
Based upon Edwards	18	
From other sources	5	
Total in 10th ed.		147
In 12th ed. (1766)	41	
Fauna Svecica (1761)	2	
Total Linnaeus		190
Gmelin (Syst. Nat., 1788-89)	71	
Other authors before Wilson—		
Vieillot	27	
Boddaert	12	
Pallas	17	
Forster	10	
Latham	9	
Twenty-six others	48	
Total before Wilson		384
Wilson	29	
Audubon	24	53
Authors since Wilson—		
Swainson	28	
Ridgway	15	
Townsend	15	
Baird	14	
Bonaparte	13	
Cassin	11	

Wagler	10
Gambel	9
Lawrence	9
Coues	8
Say	8
Lesson	7
Sclater	7
Vigors	7
Lichtenstein	5
Woodhouse	5
Forty-nine others	86
Total since Wilson and Audubon	267
Grand Total	704

The Linnaean species which occur also in Europe are chiefly water birds which have a wide distribution, such as Horned Grebe, Mallard, Gadwall, Pintail, Shoveller, Common Tern, etc. Of the land birds we have the Snowy Owl, Redpoll, Lapland Longspur, and Snow Bunting of general circumpolar distribution. The Red-spotted Bluethroat and Wheatear occur in Alaska and the Greenland subspecies of Wheatear throughout northern Canada. The Bank Swallow stands practically alone as one of the smaller land birds which is widely distributed in both eastern and western hemispheres. The remaining land birds of this group, represented by American subspecies, are: Hawk Owl, Bohemian Waxwing, Raven, Magpie, Brown Creeper, Yellow Wagtail, and Pine Grosbeak. Other species which were described later are also represented in both regions.

Linnaeus had no first hand information on American birds but collated in his great "Systema" material from all sources. Foremost among these were Catesby's two fine volumes, "The Natural History of Carolina", published about 1730. From these Linnaeus secured descriptions of the following species:

Pied-billed Grebe	Flicker
Little Blue Heron	Pileated Woodpecker
Green Heron	Red-bellied Woodpecker
Yellow-crowned Night Heron	Red-headed Woodpecker
White Ibis	Ivory-billed Woodpecker
Flamingo	Eastern Kingbird
Canada Goose	Crested Flycatcher
Wood Duck	Horned Lark
Hooded Merganser	Blue Jay
Swallow-tailed Kite	Mockingbird
Bald Eagle	Brown Thrasher
Pigeon Hawk	Bluebird
Sparrow Hawk	Golden-crowned Kinglet
Heath Hen	Cedar Waxwing

Bob-white
Whooping Crane
Killdeer
Laughing Gull
Noddy Tern
Black Skimmer
White-crowned Pigeon
Mourning Dove
Passenger Pigeon
Ground Dove
Carolina Paroquet
Yellow-billed Cuckoo
Screech Owl
Chimney Swift
Ruby-throated Hummingbird
Belted Kingfisher
Red-eyed Vireo
Parula Warbler
Yellow-breasted Chat
Redstart
Bobolink
Eastern Meadowlark
Baltimore Oriole
Purple Grackle
Summer Tanager
Cardinal
Blue Grosbeak
Painted Bunting
Goldfinch
Red-eyed Towhee
Slate-colored Junco

The next most important source of material for Linnaeus was Edwards' "History of Uncommon Birds", 1741-51. From this Linnaeus secured some northern species and various others as follows:

Great Blue Heron
Blue Goose
Black-bellied Tree-duck
Hudsonian Spruce Grouse
Sharp-tailed Grouse
Little Brown Crane
Sora
Golden Plover
Marbled Godwit
Buffle-head
Harlequin Duck
Surf Scoter
Hudsonian Godwit
Red Phalarope
Northern Phalarope
White-winged Dove
Purple Martin
Black-whiskered Vireo

Five names from other sources were: Red-billed Tropic-bird from Osbeck; Wood Ibis and Roseate Spoonbill from Marcgrave; Turkey Vulture and Wild Turkey from sources not indicated. I do not know why Linnaeus omitted a considerable number of Catesby's birds, but eight years later in the twelfth edition of the Systema, the following were added:

Blue-winged Teal
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Tufted Titmouse
Catbird
Robin
Red-wing
Orchard Oriole
Indigo Bunting

Similarly from Edwards he added:

Brown Pelican
Marsh Hawk
Ruffed Grouse
Mexican Jacana
Spotted Sandpiper
Ruby-crowned Kinglet
Blue-gray Gnatcatcher
Golden-winged Warbler
Blue-winged Warbler
Myrtle Warbler
Chestnut-sided Warbler
Oven-bird
Maryland Yellow-throat

An extensive French publication by Brisson had appeared in the meantime and from this Linnaeus secured:

Masked Duck	Red-breasted Nuthatch
Semi-palmated Sandpiper	Loggerhead Shrike
Sooty Tern	Black and White Warbler
Derby Flycatcher	Yellow-throated Warbler
Eastern Wood Pewee	Canada Warbler
Canada Jay	Scarlet Tanager
Black-capped Chickadee	Rose-breasted Grosbeak

The Water-Turkey and White-faced Glossy Ibis were added from Marcgrave, the West Indian Grebe and Purple Gallinule from sources not indicated. These were the last of the species described by Linnaeus, but he had included about one-fourth of the North American birds now known to us.

In 1788-89 a thirteenth edition of the "Systema" by Gmelin increased the number by nearly 50 per cent. The Osprey, Chuck-will's Widow, and Purple Finch were still from Catesby; the Willow Ptarmigan, Worm-eating Warbler, and White-throated Sparrow from Edwards; the Nighthawk, Phoebe, White-breated Nuthatch, and five others from Brisson. The Carolina Wren, Palm Warbler, and three others were from Buffon, a few from Steller and Hernandez, but the largest addition was from Latham who had published his "General Synopsis of Birds", 1781-1802, without using binominal names. Species from this work were:

Sooty Shearwater	Barrow's Golden-eye
White Pelican	Red-tailed Hawk
Least Bittern	Coot
Surf-bird	Wood Thrush
Bristle-thighed Curlew	Veery
Wandering Tattler	Dickcissel
Great Horned Owl	White-winged Crossbill
Merrill's Pauraque	Savannah Sparrow
Scissor-tailed Flycatcher	Sharp-tailed Sparrow
Steller's Jay	Vesper Sparrow
Varied Thrush	Song Sparrow

Two of Latham's birds, LeConte's Sparrow and Swamp Sparrow, which were described in his "Index Zoologicus", 1790, still stand in the Check-List under his name. Some half-dozen others which were incompletely described or confused with other species received their present names from later authors.

Another source of new birds for Gmelin was Pennant's "Arctic Zoology", 1784-87. From this came:

Fork-tailed Petrel
Baldpate
Green-winged Teal
Labrador Duck
Red-shouldered Hawk
Rock Ptarmigan
Yellow Rail
Black Oyster-catcher
Woodcock
Willet
Lesser Yellow-legs
Dowitcher
Avocet
Marbled Murrelet
Ancient Murrelet
Whiskered Auklet
Rufous Hummingbird

A publication in 1783 by Boddaert, Dutch doctor and naturalist, included a number of new North American birds. For the most part these were based upon earlier descriptions by Daubenton, who was at one time associated with Buffon. Many of these were apparently drawn from specimens brought by early French explorers in the West Indies, Louisiana, and adjacent regions. The species of Boddaert were:

Holboell's Grebe
Northern Clapper Rail
Royal Tern
Texas Nighthawk
Vermillion Flycatcher
Barn Swallow
Alaska Chickadee
White-eyed Vireo
Prothonatary Warbler
Water-thrush
Hooded Warbler
Cowbird

The Alaska Chickadee is regarded as a race of the Old World, Siberian Tit.

Previous to Gmelin's edition of the "Systema", J. R. Forster had published in 1771 "A Catalogue of the Animals of Hudson's Bay", a notable list of 302 species of birds but without descriptions. The next year he published some descriptions from the same region which included:

Eskimo Curlew
Greater Yellow-legs
Great Gray Owl
Hudsonian Chickadee
Black-poll Warbler
Tree Sparrow
White-crowned Sparrow

Three others, the Whip-poor-will, Nighthawk, and Northern Shrike, were indicated in his "Catalogue", the first two based upon Catesby's descriptions, the third mistaken for the European Great Grey Shrike.

Pallas, a German zoologist, described from 1769 to 1811 a number of birds which inhabit parts of Alaska as well as Siberia. These were:

Short-tailed Albatross
Pelagic Cormorant
Lesser Snow Goose
Steller's Eider
Paroquet Auklet
Crested Auklet
Least Auklet
Rhinoceros Auklet

Rufous-necked Sandpiper
Curlew Sandpiper
Sanderling
Caspian Tern
Cassin's Auklet
Tufted Puffin
Hermit Thrush
Aleutian Rosy Finch
Golden-crowned Sparrow

Vieillot, a French author, published descriptions of a large number of American birds from 1807 to 1819. To some extent these preceded the work of Alexander Wilson, and to a large extent they were unknown or unrecognized at that time. Many of his species were birds from Mexico and South America, northern forms of which were described later. From Vieillot we have:

Leach's Petrel
Fulvous Tree-duck
Cinnamon Teal
White-tailed Kite
Everglade Kite
Broad-winged Hawk
White-tailed Hawk
Short-tailed Hawk
Aplomado Falcon
Virginia Rail
Pectoral Sandpiper
White-rumped Sandpiper
Buff-breasted Sandpiper
White-eared Hummingbird
Red-cockaded Woodpecker
Couch's Kingbird
Tree Swallow
Rough-winged Swallow
Cuban Cliff Swallow
House Wren
Yellow-throated Vireo
Warbling Vireo
Sennett's Warbler
Mangrove Warbler
Prairie Warbler
Louisiana Water-thrush
Kentucky Warbler

Few of the twenty-six writers who described only one or two species each in this period are well known. The Barred Owl was described by William P. C. Barton in a fragmentary work which Coues regarded as the first to be devoted entirely to North American birds. The Ring-necked Duck was described by Donovan from a specimen found in the London markets. The Common Loon and some other water birds, all from Europe, were described by Brünnich. The Snowy Egret was first recognized from Chili by the Italian, Molina. To him is credited also the first race of the Burrowing Owl. A Danish treatise by Pontoppidan gave us the Short Eared Owl, three years before the twelfth edition of Linnaeus' "Systema". The Bittern was described by Montagu in 1813 from England where it was only an accidental visitor.

In Alexander Wilson we meet for the first time a man who lived and worked among the birds which he described. He was not born in America, nor was he born an ornithologist, but his assumption of the study later in his life has helped to give us a clear record of his work and made it purely American. His travels were largely limited to Pennsylvania, Kentucky, and neighboring states, so that for the most

part he discovered new birds in an area where much collecting had been done before. His list of warblers is especially imposing. Of course his greatest work was the description of the habits of the birds, not the discovery of new species. The ones first described by Wilson were:

Canvas-back
Mississippi Kite
Goshawk
Sharp-shinned Hawk
American Oyster-catcher
Wilson's Snipe
Wilson's Phalarope
Black-billed Cuckoo
Long-eared Owl
Lewis's Woodpecker
Acadian Flycatcher
Crow
Fish Crow
Clark's Nutcracker
Winter Wren
Long-billed Marsh Wren
Blue-headed Vireo
Tennessee Warbler
Nashville Warbler
Cerulean Warbler
Bay-breasted Warbler
Pine Warbler
Connecticut Warbler
Mourning Warbler
Wilson's Warbler
Western Tanager
Pine Siskin
Seaside Sparrow
Field Sparrow

Wilson and Audubon were two stars of the first magnitude. Audubon was American born, and certainly he was born an ornithologist with unsurpassed enthusiasm. In the old territory he was able to discover yet a few new birds: Great White Heron, Alder Flycatcher, Carolina Chickadee, Bewick's Wren, Swainson's Warbler, Bachman's Warbler, and Henslow's Sparrow. For most of these he was obliged to penetrate the swamps and remote portions of the eastern states. His journey to Labrador added Lincoln's Sparrow. He longed to visit the country west of the Mississippi River and finally in his late years succeeded in reaching the mouth of the Yellowstone River, now northwestern North Dakota. This trip yielded Nuttall's Poor-will, Sprague's Pipit, Bell's Vireo, and Baird's Sparrow. It was a great disappointment to him that he was not able to describe the birds brought from the West Coast by Townsend and Nuttall, so from the far west only the Black-footed Albatross, Western Gull, Yellow-billed Magpie, Townsend's Solitaire, Tri-colored Redwing, and Green-tailed Towhee bear his names. The following species, then, were described by Audubon:

Black-footed Albatross
Great White Heron
King Rail
Swainson's Hawk
Western Gull
Nuttall's Poor-will
Sprague's Pipit
Bell's Vireo
Swainson's Warbler
Bachman's Warbler
Western Meadowlark
Tricolored Redwing

Alder Flycatcher
Oregon Jay
Yellow-billed Magpie
Carolina Chickadee
Bewick's Wren
Townsend's Solitaire
Green-tailed Towhee
Baird's Sparrow
Henslow's Sparrow
Brewer's Sparrow
Lincoln's Sparrow

A contemporary ornithologist, correspondent and friend of Audubon's, was William Swainson, who had the opportunity of working with the numerous specimens arriving at the British Museum. He had made a trip to Mexico and from specimens collected there described many of our species. Later with John Richardson, he published a work on the animals of northern North America in which several of the northern birds were described. His list of species is:

American Scoter
Thick-billed Parrot
Groove-billed Ani
Lucifer Hummingbird
Broad-tailed Hummingbird
Rivoli's Hummingbird
Broad-billed Hummingbird
Ant-eating Woodpecker
Arctic Three-toed Woodpecker
Cassin's Kingbird
Black Phoebe
Western Wood Pewee
Violet-green Swallow
Dipper
White-throated Wren
Curve-billed Thrasher
Western Bluebird
Phainopepla
Painted Redstart
Hooded Oriole
Bullock's Oriole
Black-headed Grosbeak
Gray-crowned Rosy Finch
Arctic Towhee
California Towhee
Red-backed Junco
Clay-colored Sparrow
Smith's Longspur

Following Wilson one can hardly overlook mention of George Ord who was Wilson's literary executor and apparently the chief opponent to Audubon in the matter of the Pacific Coast specimens. Ord described the Whistling Swan from the Pacific Coast, Wilson's Plover, Ring-billed Plover, and Bonaparte's Gull from the Atlantic Coast. Audubon received more friendly coöperation from Charles Lucien Bonaparte, who continued Wilson's work and published many other papers. The species described by him were:

Black Petrel
White-winged Scoter
Cooper's Hawk
Sage Hen
Stilt Sandpiper
Zenaida Dove
Say's Phoebe
Wollweber's Titmouse
Yellow-headed Blackbird
Scott's Oriole
Pyrrhuloxia
Varied Bunting
Sharpe's Seedeater

The first noteworthy discovery of birds of the Great Plains region fell to Thomas Say in 1819. He was not especially interested in birds

but was an authority on shells, while in insects he was quite without a rival in early American work. The expedition of Major S. H. Long to the Rocky Mountains had many misfortunes. It failed to accomplish much of its plan, yet under repeated difficulties Say was able to make a large contribution to the natural history of that region. The Lark Sparrow was found in Missouri at the start, the Orange-crowned Warbler at the expedition's winter quarters at Engineer Cantonment near the present Omaha, Nebraska. The Dusky Grouse, Band-tailed Pigeon, Arkansas Kingbird, Rock Wren, Lazuli Bunting, and Arkansas Goldfinch were added to the list in Colorado.

A second notable expedition through the same region but continuing to the Pacific Coast, was that of N. J. Wyeth in 1834. Thomas Nuttall was accompanying the group to collect plants and had induced John K. Townsend, a zoologist, to go also. The first day out from their starting point at Independence, Missouri, they secured Harris's Sparrow. This was described by Nuttall six years later, and shortly afterward was discovered and described independently by both Audubon and Maxmilian. The common name given it by Audubon has fortunately been retained. On the plains of Nebraska Townsend found the Lark Bunting and Chestnut-collared Longspur; in Wyoming the Mountain Plover and Sage Thrasher. The northern Pacific Coast region yielded a rich harvest, especially of warblers, and the full list of Townsend's species is as follows:

Mountain Plover
Western Sandpiper
Vaux's Swift
Chestnut-backed Chickadee
Coast Bush-tit
Sage Thrasher
Russet-backed Thrush
Audubon's Warbler
Black-throated Gray Warbler
Townsend's Warbler
Hermit Warbler
Macgillivray's Warbler
Lark Bunting
Oregon Junco
Chestnut-collared Longspur

Townsend and Nuttall had the privilege of making the last great exploratory collection of the early days. No doubt others since have worked equally hard and even more industriously in restricted districts, but new areas of so great an extent no longer remained in the United States. Later additions came from various collections and from more intensive study of collections accumulating in the larger museums. The Southwest was little explored and in the furtherance of that as well as collections from all possible sources, S. F. Baird was responsible above all other men. He had the vision of a national museum and was tireless in his efforts to develop it.

Baird narrowly missed being a youthful associate of Audubon. With his brother, W. M. Baird, he began collecting at an early age and when he was but seventeen years old the brothers described the Least Flycatcher and Yellow-bellied Flycatcher, discovered in the well explored State of Pennsylvania. Baird's list of species is:

Aleutian Tern
Spotted Owl
Yellow-bellied Flycatcher
Least Flycatcher
Wright's Flycatcher
Gray Flycatcher
San Lucas Robin
Virginia Warbler
Grace's Warbler
Kirtland's Warbler
Rio Grand Yellow-throat
Abert's Towhee
Sage Sparrow
Pink-sided Junco

The name of William Gambel is closely associated with California natural history about the middle of the nineteenth century. The following birds were described by him, either from California or other western states:

Gambel's Quail
Elegant Tern
Nuttall's Woodpecker
Ash-throated Flycatcher
Western Flycatcher
Mountain Chickadee
Plain Titmouse
Gambel's Wren-tit
California Thrasher

Two other ornithologists of that period were J. N. Lawrence and John Cassin. Lawrence described the following, of which the last was another species of the Great Plains region which had previously escaped notice:

Western Grebe
Black Brant
California Gull
White-fronted Dove
Xanthus's Hummingbird
LeConte's Thrasher
Plumbeous Gnatcatcher
Texas Sparrow
McCown's Longspur

Cassin described the following, also from the west, excepting the Philadelphia Vireo which was yet another discovery from Pennylvania:

Ross's Goose
Heerman's Gull
Williamson's Sapsucker
White-headed Woodpecker
Black-crested Titmouse
Hutton's Vireo
Philadelphia Vireo
Lawrence's Goldfinch
Rufous-crowned Sparrow
Black-throated Sparrow
Bell's Sparrow

One of the foremost ornithologists following Lawrence and Cassin was Elliott Coues. His "Key to North American Birds" is encyclopedic, combining scientific and popular accounts to an extent not attempted by anyone else since Audubon. As an army surgeon he accompanied several important expeditions in the western states and

thus, like many others, carried on ornithological studies as a pastime. His new species were not numerous:

Black-vented Shearwater	Bendire's Thrasher
Pink-footed Shearwater	Gray Vireo
Ashy Petrel	Large-billed Sparrow
Least Petrel	Rufous-winged Sparrow

One other name remains for special comment. Robert Ridgway contributed more than anyone else to a careful study and revision of all previous descriptions. The species and subspecies which he described were numerous and many of them were from tropical America which was then receiving more attention from the North American ornithologists than it had before. In the following list credited to Ridgway, the isolated island forms are conspicuous:

New Mexican Duck	Guadalupe House Finch
Florida Duck	Guadalupe Towhee
Guadalupe Caracara	Dusky Seaside Sparrow
Sooty Grouse	Guadalupe Junco
Lesser Prairie Chicken	Baird's Junco
California Clapper Rail	Worthen's Sparrow
Guadalupe Wren	McKay's Snow Bunting
Belding's Yellow-throat	

There remain about 120 species distributed among nearly sixty authors of which many were European. They were Douglas, Eyton, Godman, Gould, Gosse, Gray, Richardson, Rothschild, Salvin, and Sclater from England; Blasius, Cabanis, Kaup, Naumann, Schlegel, and Wied (Maximilian) from Germany; Boucier, De Lattre, Lafraysne, Malherbe, Milne-Edwards, Pucheran, and Temminck from France; Brandt and Middendorf from Russia; Salvadori from Italy; Sundevall from Finland. In America were: Aiken, Allen, Anthony, Bannister, Brewster, Bryant, Cabot, Cooper, Crouch, Dall, Giraud, Goss, Henry, Henshaw, Howell, Maynard, Mowbry, Nichols, Stevenson, C. H. Townsend, Woodhouse, and Xantus.

I have attempted to give a brief account including the chief known sources and some features of interest in no more space than would be required for details of many of the individual species. A complete account would be impossible on account of lack of information.

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OBSERVATIONS ON NESTS AND YOUNG OF THE COOT*

BY GEORGE O. HENDRICKSON

The gathering of evidence which reveals the causative agents of the high mortality among young wild animals has proved a very difficult task. This problem is ever present in the minds of animal observers. Consequently, following a fall of 2.5 inches of cold rain on July 17 and 18, 1935, in the vicinity of Ruthven, Iowa, the author began to look for evidence of its effect on young wildlife.

In two hours on June 20 the writer with Logan J. Bennett, in a canoe, visited ten nests of the American Coot (*Fulica americana americana*) in Mud Lake, a marsh of 400 acres. Four nests were empty of eggs and young coots, but remnants of egg shells and feathers indicated that the nests had been used. Two of the nests were of cattail stems (*Typha latifolia*), and two of bulrushes (*Scirpus validus* and *S. occidentalis*). These nests showed two to six inches of dry material above the surface of the water, and each, though anchored in a clump of cattails or bulrushes, could be lifted up and let down quite freely in the water. It was estimated that the depth of water in the slough increased ten inches with the heavy rainfall. If these nests were used for roosting and brooding at night the young birds evidently had not been harmed by the elements at the nest. Some careful searching revealed four broods of young Coots in the slough, totaling fourteen birds with five in the largest group, which may or may not have occupied the four vacant nests.

One Coot's nest was occupied by a half-grown muskrat that was using it as a feeding station. The animal had burrowed into the nest and heaped enough additional bulrushes around and over itself to be hidden from first sight of the structure.

A sixth Coot's nest contained six eggs and one freshly hatched bird not yet able to go into the water. The nest of bulrush stems showed five inches of dry material above the water's surface. From a seventh nest a parent bird swam away and called five brooded young about two days old from the nest. They scrambled into the water at once.

Three nests appeared to be empty but the removal of one to two inches of dry material at the top uncovered one, three, and five dead young Coots about one week old in the respective nests. The dead birds were surrounded by water-soaked nesting material of cattails and

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bulrushes, and they were only about one inch above the water's surface. It is suggested that these birds drowned in the nests or died of chilling either with or without a brooding parent at the nest. Apparently these nests had not risen steadily with the deepening water.

On June 27 a trip was made to observe Coots at Goose Lake, a marsh of eighty acres near Jewell, Iowa. During six hours of poling a canoe through the thirty acres of bulrushes and cattails only eight Coots' nests were found, and they were located in an area of about 2.5 acres of cattails and bulrushes two to four feet above water about three feet deep. At a second visit on July 15 much of the remainder of the thirty-acre portion previously mentioned was covered with islands of decaying vegetation, submerged a month before, and at this second visit the several acres containing the nests were quite void of such floating material.

These eight nests were made of cattails and bulrushes. Two of the nests appeared to be unfinished and not used. Four nests showed signs of use and were water-soaked nearly to the top. A fourth nest contained seven fresh-looking eggs, and the upper four inches of cattail material was dry. Another nest showed signs of previous use by Coots but at the time of the visit was used by a muskrat as a feeding station. One brood of young was observed and clucking parents at several places in the bulrushes suggested the nearness of unseen broods. No nests were found near those adults.

On July 15 during five hours of poling through the taller vegetation between the many islands of floating debris, three additional nests came to view. One among the cattails had three fresh-looking eggs. A second among the cattails appeared to be freshly built but not in use. These two nests were within the 2.5 acre area mentioned above. The third nest was constructed of fresh leaves and stalks of arrowhead (*Sagittaria latifolia*) near the center of a five-acre patch of that plant. Four fresh-looking eggs were seen in this nest.

The brood observed on June 27 consisted of only two birds about one week old. When the canoe came near they dove under duckweeds (*Lemna* sp.) and were not seen again until 2.5 minutes afterward. Then they were discerned with difficulty as they sat on the water very still and well-covered with duckweeds. One of them was picked up and taken to rear.

Its cries were continuous until evening when it found comfort and warmth in a hastily deviced brooder consisting of a ten-gallon pail lined with an electric heating pad and completed with two feet of a feather boa. During the succeeding days it spent much time lean-

ing against the heating pad and if kept away a few moments the fledgling began its vigorous outcries. Only direct sunlight seemed to satisfy its need for warmth when away from the artificial source.

The youngster did not care to pick up its food during the first week. Particles of food had to be placed very near the beak and several times a day soft food was forced into its mouth after it appeared from daily weighing of the bird that insufficient food was being consumed. Whitish material such as clabbered milk, bread crumbs, ant pupae, and the blanched ends of dandelion leaves were taken most freely later. Egg yolk, raw, or cooked hard or soft, brought on diarrhea and weakness when tried several times. At the age of about two weeks the bird was able to eat medium-sized earthworms, but continued to show a preference for ant pupae and the white ends of dandelion leaves. A few scraps of green lettuce leaf would be taken at times. As the bird grew it begged less for food but was always willing to have food brought near the beak.

The youngster proved to be a natural climber. Aided by claws on the wings supplementing the feet, it soon learned to get out of the pail-incubator by easily crawling up the electric cord. This climbing action was very pronounced during the first ten days of its captivity. As the tendency was exhibited less it also used the wings less frequently in climbing.

The youngster did not care to spend much time in water, and demanded water warmer than tap water to paddle in during the short swims.

By July 11 its weight was 38 grams; the weight at taking was 15 grams. On that day the bird passed away suddenly while swallowing an earthworm. Presumably it choked on this large particle of food.

The knowledge of the color and nature of food preferred in captivity and its habits of demanding to be fed may help in further interpretation of the observations upon the adults, the young, and their food.

Department of Zoology and Entomology,
Iowa State College, Ames, Iowa.

GENERAL NOTES

Conducted by M. H. Swenk

A Third Three-Egg-Set of the Eastern Mourning Dove.—Of the dozens of nests of the Eastern Mourning Dove (*Zenaidura macroura carolinensis*) that I have observed, the only nest with three eggs was found April 16, 1934. The frail nest was placed in the fork of a limb, overhanging a small pond.—Katie M. Roads, *Hillsboro, Ohio.*

The European Starling in Osceola County, Iowa.—On April 22, 1936, the writer saw two European Starlings (*Sturnus vulgaris vulgaris*) in Osceola County, about a mile north of the O'Brien County line on Highway No. 59. This is the highway that extends north from Highway No. 18 a mile east of Sanborn. This record, I believe, fills up the state, the Starling having not previously been reported from Osceola County.—O. S. Thomas, *Rock Rapids, Iowa.*

The American Woodcock in Mahaska County, Iowa.—On the afternoon of April 19, 1936, I observed an American Woodcock (*Philohela minor*) four miles southwest of Pella, in Mahaska County. I approached within twenty feet of the bird and observed it for some time. When flushed, the bird circled around and came back near the same place. The area was a marshy meadow near a small creek and was very close to the highway.—W. W. Aitken, *Iowa Conservation Commission, Des Moines, Iowa.*

Black Vultures Kill and Eat New-born Lambs.—For over twenty years Black Vultures (*Coragyps atratus atratus*) have been residents of my cousin's farm. The numbers have varied from eighteen to forty, the drove now (1936) numbering eighteen. They were always associated with the Turkey Vulture (*Cathartes aura septentrionalis*). In the summer the Turkey Vultures outnumber the Black Vultures, but only three or four of the Turkey Vultures remain in the winter. In one flock of sheep the Black Vultures killed and ate every new-born lamb. They picked out their eyes, killed, and then ate them. Not only were they observed to do this, but it was noted that the Turkey Vulture had no part in these attacks. The same observations were made in the case of pigs; their eyes were picked out, they were killed, and then eaten. A few years ago on another farm Black Vultures killed and ate a few new-born pigs, but not all.—Katie M. Roads, *Hillsboro, Ohio.*

Another Record of the American Egret in Polk County, Iowa.—The writer wishes to add another record of the American Egret (*Herodias albus egretta*) to the ones that have been published by observers in the state. Three birds were seen in Polk County, Iowa, approximately three miles below Des Moines, on the Des Moines River on August 11, 1935. At the time the observation was made they were perched in the tops of a group of elm trees forty-five feet from the ground. These trees were near the water's edge. The birds were studied from a distance of sixty-five feet, so identification was positive.—Walter Rosene, Jr., *Ogden, Iowa.*

The Red-shafted Flicker in Boone County, Iowa.—During a severe snow storm on January 30, 1936, I observed a Red-shafted Flicker (*Colaptes cafer collaris*) at my home in Ogden, Iowa. A strong wind was blowing from the north and it flew directly over me toward the southwest, and the red under parts were plainly visible without the use of glasses. It alighted on the sheltered side of a

tree across the street and remained there for some time, allowing me to examine it carefully through 8x binoculars at a distance of about sixty feet. I noted the red-shafted feathers and also the V-shaped red patch on the back of his head, thus indicating that it must have been a hybrid. As it flew away, I again noted the red-shafted feathers in flight. A few days later I again observed another bird about a block away and it disappeared in a hollow tree. This probably was the same bird. Temperature on the date of the first observation was eight degrees below zero. I have searched for the bird since, but failed to find it. This is my first record of this species in central Iowa in nineteen years of careful observation.—Walter M. Rosene, *Ogden, Iowa.*

Bird Notes from Morris County, New Jersey.—On March 14, 1936, while driving slowly along the cement road running between Florham Park and Morristown, New Jersey, I observed a female Old-squaw (*Clangula hyemalis*) in full winter plumage, swimming and diving in the flood water that covered the marshes directly next to Ely's Aquatic Farm. The bird was within 100 feet of the road and appeared to be absolutely unsuspicious. It showed no fear when I left the car, and I was able to study it carefully at this range with 8x glasses. So close was I to the bird that I could follow with the naked eye its course under the water by the small trail of bubbles that came to the surface when it submerged. It was diving continually, the dives following each other at approximately twenty seconds. The duration of submergence averaged twelve seconds. The bird was still present the next day at the same spot and was as easily observed. This is an unusual record for this vicinity.

On March 22, 1936, I had under observation a pair of Hooded Mergansers (*Lophodytes cucullatus*), male and female, on the Passaic River within a quarter mile of the Chatham Bridge on the Morris Turnpike, Chatham, New Jersey. I first noticed the male resting quietly on the water. The bird became alarmed when I started inching forward on my stomach and flew fifty yards or so upstream. It rapidly drifted back down again to its former position, and I noted for the first time a darker bird—its mate—which it joined. They evidently lost their suspicions and both of them commenced diving, the two of them submerging together. During the period of submergence I was able to creep much closer, concealing myself as well as possible, and was rewarded with a fine, clear view of the birds. I had Peterson's *Field Guide* with me, and a comparison of the plate with the living bird made exact identification possible. After observing them for ten minutes I continued to creep forward with a view toward getting a glimpse of four American Mergansers (*Mergus merganser americanus*), which were farther upstream. My movements frightened the two birds and they flew quickly up the river out of my sight. The Hooded Mergansers are rare transients in this vicinity.—Paul Murphy, *Summit, N. J.*

A Herring Gull Attacked by a Bald Eagle.—On January 31, 1936, Mr. O. K. Scott and the writer saw an immature Bald Eagle (*Haliaeetus leucocephalus* subsp.) kill and devour a first-year Herring Gull (*Larus argentatus smithsonianus*) on the ice of the Merrimac River at Newburyport, Massachusetts. When first seen, the eagle was standing on the ice about twenty feet from the gull, which was sitting quietly. As we watched, the eagle flew up into the air and over the gull, looking down at it. The gull remained sitting on the ice but threw back its head and raised its beak upward toward the eagle, at the same time spreading its

wings somewhat. The eagle alighted about twenty feet away, and the gull resumed a normal sitting position. This performance was shortly repeated. The eagle rose a third time, and this time alighted on the gull, then almost at once released it. The gull must have been incapacitated before we arrived on the scene, and it was now very badly injured. It flopped along on the ice for a few yards, when the eagle again rose and came down on it, after which the gull did not move. The young eagle stood on the gull looking disinterestingly about for fully half a minute, then slowly and half-heartedly began to pluck and eat the bird. At this point we heard the muffled crack of a small firearm and the eagle with one flap of his wings jumped vertically into the air about four feet, carrying his prey with him, and making his upward leap with apparent ease, as if unencumbered. Several more shots were fired, but the eagle paid them no attention. —Hustace H. Poor, *Cambridge, Mass.*

Effects of the Severe Winter of 1935-36 on Bird Life in the Fort Wayne, Indiana, Area.—In common with the rest of the Middle West, the Fort Wayne area has just passed through its most severe winter in many years. For more than two months the ground was blanketed with snow. Ice froze from two to three feet deep on every quiet body of water. Frost pierced the ground everywhere to a depth of four feet or more. The belated break finally came on February 23, and when it came, it came with a suddenness and a completeness that is most unusual in this area.

In our immediate vicinity, bird life came through the siege of arctic weather surprisingly well. The chief reason for this was that at no time was the food supply of the wintering birds sealed away from them by ice. Weed seeds, berries, and fruits were available in normal abundance at all times. Crusted snow made access to the ground difficult, and in large areas almost impossible, but species that feed normally on the ground suffered not so much from lack of food as from the difficulty of finding gravel suitable for use in grinding their food.

All of the normal winter residents here were present in their usual abundance. In addition, such species as Mourning Doves, Robins, Red-winged Blackbirds, and Grackles stayed over in their usual small numbers, and a normal percentage of these individuals survived. Meadowlarks and Bob-whites were present as usual in all favorable areas, and these species did as well as usual. Meadowlarks were present constantly in an area around my feeding station on the edge of town, yet at no time did they find conditions bad enough to make them other than irregular visitors there. Even a few Carolina Wrens stayed out the winter in our area, which is very near the northern limit of their range.

Had it not been for the presence of some of our rarer winter visitors in unusual numbers, this last winter would have been little different from many others, so far as bird life is concerned. The influx of birds from less fortunate areas was the most interesting feature of the period. The most conspicuously unusual occurrence was the influx of water birds. The sewage-laden Maumee River was open for several miles below the city. Ordinarily it has little to attract the various species of winter ducks, but this winter large numbers of American Golden-eyes and American Mergansers found a haven in its carp-infested waters. Red-breasted Mergansers, Old-squaw, and Herring Gulls also were present in small numbers. In the city all of the rivers were frozen solid, except for a small patch of water in the St. Joseph River kept open by the discharge from a power plant. Here a

single Horned Grebe found its haven and stayed for weeks. Golden-eyes, Mergansers, an Old-squaw, and an occasional Belted Kingfisher paid it frequent visits, but it became characteristic of that patch of water. Some of these water birds lingered on our rivers long after the break in the winter, but most of them went with the snow and ice. Other unusual winter visitors in our area included Snow Buntings and Lapland Longspurs. Both species came with large flocks of Horned Larks, and I fed both of them more or less regularly in the yard, along with the larks. One Longspur that was present only on February 9 was an adult male in an almost typical nuptial plumage. All of the others were in normal winter plumage. Among the Horned Larks, individuals that were typically *alpestris* could be picked out, as also could typical representatives of the subspecies *praticola*. The great majority of individuals, however, were in an intermediate plumage which left me somewhat confused as to their proper subspecific rank.

The effect of the severe winter on the spring migration dates in the Fort Wayne area has been negligible. True, all of the extremely early February dates were eliminated, but when the break in the weather did come, it came so completely that March dates for all species averaged about normal.—Perry Frank Johnson, *Fort Wayne, Ind.*

The 1935 Fall Migration at the Washington Monument.—The Washington Monument, a white stone shaft rising 555 feet in height, is situated near the busiest part of the city of Washington, D. C., and affords an opportunity for quite an unusual method of bird study. For several years after the monument was erected, birds in migration struck it by the score, thousands probably being killed by coming into forcible contact with it. Reports state that it was not an unknown occurrence to pick up a bushel of dead birds at its base that had been killed during a single night.

Later, as the city grew, either the birds changed their course of flight or the survivors became educated concerning the dangers of the Washington Monument. At least in recent years very few birds were striking the monument each season until 1932, when it was decided to flash giant beacons on the shaft from dusk until 11:45 each night. That year, 1932, Miss Phoebe Knappen of the United States Biological Survey, who is keenly interested in all bird data taken at the Washington Monument, picked up 324 birds at the monument, and the next year she gathered a total of 331 birds, mostly warblers and vireos.

Last fall (1935) I visited the monument each night (with a few exceptions) from August 30 to November 7. Before listing a few statistics on the results of my nightly observations, I shall describe briefly a typical "good bird night", that of September 6, 1935. The weather was clear, but there was no moon. There was not much wind. Early in the evening the first birds struck the monument, and others came tumbling down its sides until the beacon lights were turned out at 11:45. At times birds were raining down so fast that the three of us who were watching that night could not keep track of them all. We could hear the birds chirping as they neared the monument, and then could see them, as they came into the path of the lights, three, four, or five hundred feet above us, fly directly toward the monument. Many birds would immediately strike head-on with an audible blow, and would drop like plummets to the concrete at the base with quite a loud thud. Others, though they seemed to strike as hard,

would back away from the monument after the impact and continue their journey. Still others would strike their heads on the stone again and again, each time at a lower level than the time before, and finally would come fluttering down the sides vainly trying to find a foothold on the smooth surface. Several of these latter were saved from probable death by landing in our outstretched hands. Those that seemed none the worse for the experience we let fly away at once. Many of the birds, either from their own efforts or the action of the wind, dropped at a considerable distance from the monument. We located these with flashlights.

We took home with us that night a total of seventy-four birds, twenty-one of which were liberated the next day, seemingly fully recovered. The other fifty-six were dead when we picked them up, or died during the night. Of the seventy-four birds, forty-six were Red-eyed Vireos. There were ten Maryland Yellow-throats, three Magnolia Warblers, three Yellow-breasted Chats, and two Bay-breasted Warblers. There was one each of the following species: Black and White Warbler, Redstart, Blackburnian Warbler, Black-throated Green Warbler, and Scarlet Tanager.

During the entire 1935 fall migration thirty-three species, comprising 246 individuals, were obtained near the base of the Washington Monument. They include: Northern Flicker, 1; Yellow-bellied Sapsucker, 1; Brown Creeper, 2; Long-billed Marsh Wren, 2; Short-billed Marsh Wren, 1; Catbird, 1; Golden-crowned Kinglet, 3; Eastern Ruby-crowned Kinglet, 1; White-eyed Vireo, 4; Blue-headed Vireo, 1; Red-eyed Vireo, 110; Philadelphia Vireo, 2; Black and White Warbler, 1; Tennessee Warbler, 1; Nashville Warbler, 1; Parula (Parula and Northern Parula), 3; Magnolia Warbler, 31; Cape May Warbler, 1; Black-throated Blue Warbler, 1; Black-throated Green Warbler, 15; Blackburnian Warbler, 3; Bay-breasted Warbler, 2; Black-poll Warbler, 3; Yellow Palm Warbler, 2; Ovenbird, 2; Connecticut Warbler, 2; Yellow-throat (Northern and Maryland), 31; Yellow-breasted Chat, 10; American Redstart, 4; Scarlet Tanager, 1; Eastern Grasshopper Sparrow, 1; Field Sparrow, 1; Eastern Song Sparrow, 1.

The above list includes all birds taken at the monument. Thirty-six of the birds were recovered and include twenty-eight Red-eyed Vireos, three Magnolia Warblers, four Maryland Yellow-throats, and one Ruby-crowned Kinglet. I personally handled and identified (or in a few cases had Dr. Oberholser or others verify my identifications) practically every one of the 246 birds. I prepared sixty of the birds for my collection.

A few facts concerning migration at the monument may be mentioned. Nearly all birds struck the monument on nights when there was no moon. There were more fatalities on windy nights than on calm nights. Over one-half of the birds struck the monument on the east face, and nearly all of the rest on the south face. Why this should be I cannot quite figure out—all faces are illuminated identically; the direction of migration is from northeast to southwest; and the wind usually was from the west, northwest, or southwest. Why do so many birds hit the south side and so few the north? Miss Knappen tells me it is the same each year.

Nearly all birds were in immature or juvenile plumage, which made the identification of several difficult and fascinating. Nearly all stomachs were examined, but none contained any food whatsoever. As may be expected, most of the birds had fractured skulls. There were few broken wings and legs. The vireos, being

heavier than the warblers, would strike the monument much harder, and a larger percentage of them would fall.

On rainy or misty nights, Whip-poor-wills, apparently feeding upon insects attracted by the beacons (which are on the ground in large boxes around the base of the monument) flew round and round the monument at low levels, often as low as our heads. Once a Whip-poor-will came so close to me that I could see his large luminous brick-red eye.

On October 20, hundreds of Field Sparrows settled on the benches and light boxes at the base of the monument, apparently resting. None of these sparrows struck the monument that night, nor did they seem confused by the lights nor fly against the shaft, as the vireos and warblers were doing. Besides the birds, four bats died from striking the monument while in pursuit of insect prey. Three were Red Bats, the other a Little Brown Bat. Very few birds strike the monument during spring migrations, according to Miss Knappen.

Mr. Allen McIntosh of the Bureau of Animal Industry, examined 190 of the birds for parasites. An abstract of his results is published in the *Journal of Parasitology*, Vol. 21, No. 6.—Robert Overing, *Landover, Md.*

Concerning the Southern Range of the Cowbird.—In the Wilson Bulletin for March, 1936, on page 13, Mr. Thomas D. Burleigh in an article on the Cowbird (*Molothrus ater*) states in the second paragraph, "actual records of eggs or young in that state (Virginia) are scarce". On page 199 of my book on the "Birds of Virginia" one will see that breeding Cowbirds are very common in Virginia, and I have in my collection some thirteen sets of eggs representing ten different species, with Cowbird eggs in them. All were personally taken by my father, Mr. H. B. Bailey, and me. On my farm in Warwick County, Virginia, fronting on the James River, and now used as the Country Club, I threw dozens of Cowbird eggs out of nests yearly while residing there, from 1906 to 1919, for I did not wish further sets with Cowbird eggs in them. As to Mr. Burleigh's remarks regarding the A. O. U. Check-List stating that the Cowbird does not breed south of central Virginia, that is an error on the part of the Check-List, for I have found them breeding as far south as Florida, and have taken locally reared young at Cape Sable, Monroe County, during the first week in August.—Harold H. Bailey, *Miami, Fla.*

Bird Banding in Luce County, Michigan, in the winter of 1935-36.—The winter of 1935-36 has been a cold one in this locality, there being only three days in February up to the 21st that the temperature has not been to zero or below. Only a few species of birds are wintering, and my list for this year so far numbers only ten. Banding has been favorable. I have had 129 Snow Buntings, eight Redpolls (four were the Common, and four perhaps the Hoary), and one Northern Shrike to band. Have had nine Snow Buntings that I banded in the winter of 1934-35, nine from the winter of 1933-34, one from the winter of 1932-33, and one from the winter of 1930-31. Also had one Common Redpoll from the winter of 1933-34, this being my first return.—Oscar McKinley Bryens, *McMillan, Mich.*

COMMUNICATIONS

June 22, 1936.

To the Editor:

Although I am no longer living in the Yellowstone Park, my attention is always attracted to articles pertaining to birds of that region. In fact, I have been for the last thirty years listing in my Yellowstone Bird Bibliography all articles I could find mentioning even one bird in that Park. Hence, my interest in Mr. Crook's article on pages 136-137 of the June WILSON BULLETIN. If you will look up page 128 of The Condor, Vol. XXXI, No. 3, May-June, 1929, you will find that there is an item there recording the discovery of the "Double-crested Cormorant in Yellowstone National Park", on July 20, 1928. Apparently these were the same birds, and the same nest, seen later that year by Dr. Kelly. As to whether *auritus* or *albociliatus* is the correct form, can not yet be decided definitely because no one has taken a specimen at Yellowstone Lake. According to the 4th edition of the A. O. U. Check-List, *albociliatus* is the Pacific Coast form whereas *auritus* is the eastern form. From my knowledge of the region, I believe that the cormorant came from the east (plains) first to the lake backed up by the dam above Cody, Wyoming, and then westward to the Yellowstone Lake. Bent gives *auritus* as the breeding form at Buffalo, Wyoming, and Great Salt Lake, although he later says the Great Salt Lake birds may be intermediate.

So far as Black Ducks in the Yellowstone are concerned, I have in my own notes: "On August 7, 1922, I saw four very black ducks on Mt. Everts, but I assumed that they were dark members of the mallard species because I did not care to assume the responsibility of adding such a new species to the list on sight identification." Both Mr. Crook's ducks and mine were in northern Wyoming, but very close to the southern boundary of Montana. Wilbur C. Knight, in his "The Birds of Wyoming", does not list the Black Duck. Grave and Walker, in their "Wyoming Birds", admit it only to their Hypothetical List. Aretas A. Saunders, in his "A Distributional List of the Birds of Montana", does not admit the Black Duck even to his Hypothetical List. In the absence of authentic records from both States, would it not be better to await actual specimens before recording this species as present on the authority of sight records? I think I am fairly liberal in admitting the validity of sight records in very many instances, but my own hesitancy in recording the Black Duck after twenty-four (in 1922) years' experience with Yellowstone birds shows that I did not then consider myself qualified to record it on a sight record.

Yours truly,

Long Beach, Calif. M. P. SKINNER.

EDITORIAL

THE WILSON ORNITHOLOGICAL CLUB will hold its Twenty-second Annual Meeting in Chicago on November 27-28, of this year. The sessions will be held in the Chicago Academy of Sciences, with the Inland Bird Banding Association participating. Mr. W. I. Lyon is Chairman of the Local Committee. Those who expect to present papers on the program are asked to notify Dr. L. E. Hicks, Secretary of the W. O. C., Ohio State University, Columbus, Ohio.

OUR READERS are again reminded that notes on the effects of the drouth on bird life are of much interest at this time. Have any definite observations been made on the effects of drouth on birds that use mud in nest building? Or on the fall movements of shore birds? Have there been as many northern records as usual of "white herons" and egrets, or have the dried-up sloughs retarded this movement? Has there been a scarcity of berries and winter fruit, which has had any effect on the usual abundance of birds in a given area? Has the abundance of certain foods, such as "grasshoppers", brought any increase in certain birds? Have rails, coots, and grebes nested in their accustomed haunts?

The *Ibis* for July, 1936, contains a most instructive summary of recent literature on the migration of birds, by Dr. A. Landsborough Thomson, author of "Problems of Bird Migration". This paper covers the literature of a ten-year period from 1926 to 1935, inclusively. The year 1926 brought out three important books on bird migration, namely, those by Wachs, Wetmore, and Thomson. The present paper by Thomson is valuable in collating the scattered literature since that time. The accompanying bibliography contains 209 titles, not counting secondary references. As a matter of curiosity we were interested to know whether our own periodical contributed its share of this literature. A count shows that American ornithological journals were each cited the following number of times: The *Auk*, 13; the *Condor*, 7; the WILSON BULLETIN, 6; *Bulletin Northeastern Bird Banding Association*, 4; *Bird-Banding*, 2. Using this bibliography as a test it was found that the WILSON BULLETIN occupied seventh place, tying with three others, among the ornithological periodicals of the world, in the matter of frequency of citation.

THE UNITED STATES BIOLOGICAL SURVEY has again failed in its opportunity to give the wild fowl of the continent a respite from hunters. It had seemed to us that the stage was nicely set for a closed season. We wish we might know a little more about the mysterious pressure which seems to bear on government officials.

Dr. Carl P. Russell has been appointed Chief of the Wildlife Division of the National Park Service, taking the vacancy caused last spring by the death of George M. Wright.

MEMBERSHIP ROLL

MEMBERSHIP ROLL OF THE WILSON ORNITHOLOGICAL CLUB*

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Ganier, Albert F., 2507 Ashwood Ave., Nashville, Tennessee....1915
Getz, Christian J., 3503 Middleton Ave., Cincinnati, Ohio....1930
Green, Morris M., 39 S. Wyoming Ave., Ardmore, Pennsylvania....1931
Hann, Dr. Harry W., Zoology Dept., Univ. of Michigan, Ann Arbor, Mich....1930
Harriot, S. C., 200 W. 58th St., New York City....1934

*This is a complete membership roll of the Wilson Ornithological Club according to present records. If any names are omitted it has been from oversight. All members are urged to notify the Secretary of any errors in spelling, titles, dates, or address. Please notify us promptly when address changes are made. Errors in address cost in money and inconvenience.

†Deceased.

Havemeyer, Harry O., Mahwah, New Jersey....1930
Howell, Arthur H., 2919 S. Dakota Ave., Washington, D. C....1921
Kennard, Frederick Hedge, 246 Dudley Road, Newton Center, Massachusetts....1919
Magee, Michael J., 603 South St., Sault Ste. Marie, Michigan....1919
Marmon, Mrs. Elizabeth C., 970 Delaware St., Indianapolis, Indiana....1933
Mitchell, Dr. Walton I., 1644 Visalia Ave., Berkeley, California....1893
Nelson, Miss Theodora, % Zoology Dept., Univ. of Mich., Ann Arbor, Mich....1928
Phillipp. Frederick B., West Rd. and Herbert Gap Rd., Short Hills, N. J....1933
Phillipp, Philip B., 220 Broadway, St. Paul Bldg., New York City....1914
Roads, Katie M., 463 Vine St., Hillsboro, Ohio....1914
Roberts, Dr. Thomas S., Museum of Natural History, University of Minnesota, Minneapolis, Minnesota....1914
Shaver, Dr. Jesse M., Peabody Teacher's College, Nashville, Tennessee....1922
Shearer, Dr. Amon Robert, Mont Belvieu, Chambers County, Texas....1893
Stephens, Prof. T. C., Morningside College, Sioux City, Iowa....1911
Stoddard, Dr. H. L., Route 5, Sherwood Plantation, Thomasville, Georgia....1916
Sutton, Dr. George Miksch, Bethany, West Virginia....1920
Swenk, Prof. Myron H., 1410 N. 37th St., Lincoln, Nebraska....1914
Thorne, Mrs. W. V. S., 810 Fifth Ave., New York City....1930
Todd, W. E. Clyde, Carnegie Museum, Pittsburgh, Pennsylvania....1911
Uhrig, Mrs. A. B., 425 E. Water St., Oconomowoc, Wisconsin....1926
Young, Colonel John P., Renwick Drive, Ithaca, New York....1913

Active Members

Agostini, Charles T., Carnegie Museum, Pittsburgh, Pennsylvania....1931
Aldrich, John W., Cleveland Museum of Natural History, Cleveland, Ohio....1930
Allen, Dr. Arthur R., McGraw Hall, Cornell University, Ithaca, New York....1914
Allen, Durward Leon, Kellogg Bird Sanctuary, Augusta, Michigan....1933
Bailey, Alfred M., Chicago Academy of Sciences, Chicago, Illinois....1928
Bartel, Karl E., 2528 W. Collins St., Blue Island, Illinois....1934
Bartsch, Dr. Paul, U. S. National Museum, Washington, D. C....1894
Bennett, Mary A., 623 E. Carroll St., Macomb, Illinois....1933
Bennett, Walter W., Arnolds Park, Iowa....1925
Bent, Arthur Cleveland, 140 High St., Taunton, Massachusetts....1893
Blain, Dr. Alexander W., 2201 Jefferson Ave., East, Detroit, Michigan....1902
Blake, Mrs. Charles, Massachusetts Institute of Technology, Cambridge, Massachusetts....1935
Blincoe, Benedict Joseph, Route 13, Dayton, Ohio....1920
Bowdish, B. S., Demarest, New Jersey....1924
Brant, Irving W., % St. Louis Star, St. Louis, Missouri....1932
Breckenridge, Walter J., Museum of Natural History, University of Minnesota, Minneapolis, Minnesota....1929
Brockner, Winston W., 175 Dutton Ave., Buffalo, New York....1933
Brooks, Allan, Okanagan Landing, British Columbia....1930
Brooks, Earle A., 166 Plymouth Road, Newton Highlands, Massachusetts....1933
Broun, Maurice, P. O. Orleans, % Miss Bessie Penniman, Cape Cod, Mass....1935
Brunn, Charles A., 1510 Central Ave., Hot Springs, Arkansas....1921
Bryens, Oscar McKinley, McMillan, Luce Co., Michigan....1924
Buchanan, Charles J., Marott Hotel, Indianapolis, Indiana....1933
Burdick, Dr. Harold C., P. O. Box 164, Milton, Wisconsin....1929
Burleigh, Thomas D., 400 Union Bldg., 837 Gravier St., New Orleans, La....1922
Burtch, Verdi, Branchport, New York....1924
Butler, Dr. Amos W., 52 Downey Ave., Indianapolis, Indiana....1911
Cahalane, Victor H., Wildlife Division, National Park Service, Washington, D. C....1933
Carpenter, F. S., 2402 Longest Ave., Louisville, Kentucky....1934
Chase, H. D., University of Tulsa, Tulsa, Oklahoma....1935
Chase, Henry B., Jr., Southern Biological Supply Co., New Orleans, La....1932
Chapman, Dr. Frank M., American Museum of Nat. Hist. New York City....1910
Christy, Bayard H., 403 Frederick Ave., Sewickley, Pennsylvania....1922
Clay, Miss Marcia B., Bristolville, Ohio....1924

Coffey, Ben, Tennessee Inspection Bureau, 1434 Bank of Commerce Bldg., Memphis, Tennessee....1928
Coffin, Mrs. Percival Brooks, 624 S. West A St., Richmond, Indiana....1936
Colburn, Albert E., 716 South Flower St., Los Angeles, California....1928
Cole, Dr. Leon J., Genetics Bldg., University of Wisconsin, Madison, Wisc....1921
Cook, G. M., 2301 Elm St., Youngstown, Ohio....1923
Cottam, Clarence, U. S. Bureau of Biological Survey, Washington, D. C....1929
Danforth, Prof. Stuart T., Box 541, Mayaguez, Porto Rico....1924
Dawson, Sallie, 807 N. 4th St., Terre Haute, Indiana....1933
DeLury, Dr. Ralph E., Dominion Observatory, Ottawa, Ontario....1920
Dickinson, F. R., 1518 Astor St., Chicago, Illinois....1931
Dodge, Thomas H., P. O. Box 169, Gallup, New Mexico....1933
Dodge, Victor K., 137 Bell Court West, Lexington, Kentucky....1935
Douglass, Donald W., Dept. of Biology, Texas Technical College, Lubbock, Texas....1929
DuMont, Philip A., Sand Lake Waterfowl Refuge, Columbia, South Dakota....1928
Eifrig, C. W. G., 1029 Monroe Ave., River Forest, Illinois....1907
Ekblaw, Dr. George E., 506 W. Main St., Urbana, Illinois....1915
Ekblaw, Prof. W. Elmer, Clark University, Worcester, Massachusetts....1910
Emilio, S. Gilbert, 7 Winter St., Salem, Massachusetts....1929
English, Dr. P. F., Department of Forestry, Connecticut State College, Storrs, Connecticut....1934
Ernst, Miss Lillie R., 6058 Kingsbury, St. Louis, Missouri....1935
Errington, Dr. Paul L., Iowa State College, Ames, Iowa....1932
Fleming, James Henry, 267 Rusholme Rd., Toronto 4, Ontario....1906
Floyd, Judge Joseph L., 1009-11 Geo. D. Harter Bank Bldg., Canton, Ohio....1903
Frazier, John M., Station A, Box 156, Hattiesburg, Mississippi....1930
Freer, Prof. Ruskin S., Lynchburg College, Lynchburg, Virginia....1930
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Gabrielson, Dr. Ira N., Chief, U. S. Biological Survey, Washington, D. C....1913
Gallagher, William, 201 Smith Ave., Kirkwood, Missouri....1936
Gault, Benjamin True, 563 Main St., GlenEllyn, DuPage Co., Illinois....1895
Golterman, Miss Elizabeth, Educational Museum, St. Louis, Missouri....1935
Gregory, Stephen S. Jr., Box N, Winnetka, Illinois....1922
Grinnell, Dr. Joseph, Museum of Vertebrate Zoology, University of California, Berkeley, California....1914
Guest, Marjorie Lee, Athens State Hospital, Athens, Ohio....1924
Hand, Ralph L., 428 11th St., St. Maries, Idaho....1933
Handlan, John W., Oglebay Park, Wheeling, West Virginia....1932
Handlan, J. T. Jr., 91 Lynwood Ave., Wheeling, West Virginia....1934
Helmuth, Dr. William T., 667 Madison Ave., New York City....1934
Hendrickson, Prof. George O., Dept. Zoology, Iowa State College, Ames, Iowa....1933
Herrick, Dr. Francis H., 2863 Noble Rd., Cleveland Heights, Ohio....1917
Hetler, Dr. Donald M., Dept. Bacteriology, Washington University Medical School, St. Louis, Missouri....1935
Himmel, Dr. Walter J., Dept. of Botany, Univ. of Nebraska, Lincoln, Nebr....1915
Hines, Frank J., President, Western State College, Kalamazoo, Michigan....1934
Hinnen, Dr. G. A., 1343 Delta Ave., Cincinnati, Ohio....1934
Hinshaw, Thomas D., 1908 Scottwood Ave., Ann Arbor, Michigan....1926
Holt, Ernest G., Chief, Wildlife Division, U. S. Soil Conservation Service, Washington, D. C....1926
Jenner, William, 806 West Davis St., Fayette, Missouri....1933
Johnson, Archibald, Stewart, Nevada....1934
†Johnson, Dr. Charles E., Roosevelt Wildlife Station, New York State College of Forestry, Syracuse, New York....1933
Jones, Sterling P., 690 Bonita Ave., Webster Groves, Missouri....1935
Jung, Clarence S., 4612 N. Oakland Ave., Milwaukee, Wisconsin....1921
Kalmbach, E. R., 527 Custom House, Denver, Colorado....1926
Kelso, Leon, Food Habits Research, U. S. Biological Survey, Washington, D. C....1930

Kendeigh, Dr. S. Charles, Biological Laboratory, Western Reserve University, Cleveland, Ohio....1923
Kirn, Albert J., Box 157, Somerset, Texas....1918
Laird, Miss Lonnie, 3664 Washington St., St. Louis, Missouri....1935
Lapp, O. Vernon, Soil Conservation Nursury, Havana, Illinois....1936
Larrabee, Prof. Austin P., Yankton College, Yankton, South Dakota....1921
Laskey, Mrs. F. C., Graybar Lane, Nashville, Tennessee....1928
Leopold, Prof. Aldo, 1532 University Ave., Univ. of Wisconsin, Madison, Wisconsin....1928
Lewis, John B., Amelia, Virginia....1924
Lewy, Dr. Alfred, 2051 E. 72nd Place, Windsor Park, Chicago, Illinois....1915
Loftus, Miss Anne, 2035 Alta Ave., Louisville, Kentucky....1935
MacCracken, Dr. W. H., Detroit College of Medicine and Surgery, 1516 St. Antoine St., Detroit, Michigan....1933
Magann, J. Wilbur, Oklahoma Gas and Electric Co., Oklahoma City, Okla....1927
Maillaird, Joseph, 1815 Vallijo St., San Francisco, California....1930
Marsh, V. L., 340 Madison St., Missoula, Montana....1934
Mayfield, Prof. G. R., Vanderbilt University, Nashville, Tennessee....1917
McAtee, W. L., U. S. Biological Survey, Washington, D. C....1911
McCabe, T. T., Museum of Vertebrate Zoology, Berkeley, California....1928
McConnel, H. B., Cadiz, Ohio....1935
McCreary, Otto, Agricultural Hall, Univ. of Wyoming, Laramie, Wyoming....1930
McMath, Robert R., Route 4, Pontiac, Michigan....1934
Mershon, William Butts, Saginaw, Michigan....1910
Metcalf, Prof. F. P., Lingnan University, Canton, China....1919
Metcalf, Prof. Zeno P., State College, West Raleigh, North Carolina....1900
Minich, Edward C., 1047 Fairview Ave., Youngstown, Ohio....1923
Mitchell, Mrs. Osborne S., 69 Oroile Rd., Toronto, Ontario....1933
Morse, Harry G., Huron, Ohio....1914
Morse, Margarette E., 11432 Mayfield Rd., Cleveland, Ohio....1921
Moseley, Prof. Edwin L., State College, Bowling Green, Ohio....1925
Mote, G. A., Marshalltown, Iowa....1930
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Nice, Dr. Leonard B., Chicago Medical School, 710 S. Lincoln St., Chicago, Illinois....1932
Nice, Margaret M., Chicago Medical School, 710 S. Lincoln St., Chicago, Illinois....1921
Nichols, Charles K., 212 Hamilton Rd., Ridgewood, New Jersey....1933
Northcutt, Charles E., 514 Worley, Columbia, Missouri....1930
Oberholser, Dr. Harry Church, 2805 18th St., N. W., Washington, D. C....1894
Osgood, Dr. Wilfred Hudson, Field Museum of Natural History, Chicago, Ill....1910
Over, Prof. William H., University Museum, Vermillion, South Dakota....1930
Palmgren, Dr. Pontus, Museum Zoologicum, Universitatis, Helsenki, Soumi, Helsingfors, Finland....1935
Palmer, Dr. Theodore S., 1939 Biltmore St., N. W., Washington, D. C....1914
Parker, Herbert, South Lancaster, Massachusetts....1928
Pemberton, John Roy, 3031 N. Lake Ave., Altadena, California....1922
Perkins, Samuel E., III, 709 Inland Bldg., Indianapolis, Indiana....1923
Peterson, Roger Tory, National Association Audubon Societies, 1775 Broadway, New York, N. Y....1935
Pettingill, Dr. Olin S. Jr., Maple St., Middleton, Massachusetts....1930
Phelps, Frank M., 312 5th St., Elyria, Ohio....1912
Phillips, Allan R., Museum of Northern Arizona, Flagstaff, Arizona....1934
Pickwell, Prof. Gayle B., Dept. Natural Science, San Jose State Teachers College, San Jose, California....1923
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Preble, Edward A., U. S. Biological Survey, Washington, D. C....1929
Quillian, Prof. Marvin C., Wesleyan College, Macon, Georgia....1927
Rahe, Carl W., 4666 Turney Rd., Cleveland, Ohio....1931
Randall, Mrs. W. S., 4424 Bellclaire Ave., Dallas, Texas....1925

Riley, Joseph Harvey, U. S. National Museum, Washington, D. C.....1914
Rogers, Mrs. Walter E., 911 East North St., Appleton, Wisconsin.....1931
Rosene, Walter M., Ogden, Iowa.....1923
Rust, Henry J., Box 683, Coeur d'Alene, Idaho.....1921
Satterthwait, Dr. A. F., 806 W. Ohio St., Urbana, Illinois.....1935
Satterthwait, Elizabeth Allen, 806 W. Ohio St., Urbana, Illinois.....1925
Saunders, W. E., 352 Clarence St., London, Ontario.....1902
Schaefer, Oscar Frederick, 724 Woodbine Ave., Rochester, New York.....1921
Schorger, Dr. A. W., 168 N. Prospect Ave., Madison, Wisconsin.....1927
Schaffer, Chester M., Dorcas, West Virginia.....1934
Shelford, Prof. Victor E., Vivarium Bldg., Wright and Healy Sts., Urbana, Illinois.....1931
Skinner, Milton P., 1316 Harding St., Long Beach, California.....1926
Smith, Prof. Frank M., 79 Fayette St., Hillsdale, Michigan.....1910
Smith, Frank R., 9 Sibley Ave., Hyattsville, Maryland.....1930
Smith, Luther Ely, Southwestern Bell Telephone Co., St. Louis, Missouri.....1936
Spiker, Charles J., Branchport, New York.....1916
Stebbins, Miss Fannie A., 31 Ely Ave., West Springfield, Massachusetts.....1935
Stillwell, Jerry E., 7460 San Benito Way, Route 4, Dallas, Texas.....1935
Stoner, Dr. Dayton, New York State Museum, Albany, New York.....1912
Stuart, Anne, 1905 D St., Lincoln, Nebraska.....1924
Sutton, Mrs. J. G., 122 South West 7th St., Richmond, Indiana.....1930
Thomas, Edward S., 1116 Madison Ave., Columbus, Ohio.....1921
Tinker, Almerin David, 519 Oswego, Ann Arbor, Michigan.....1909
Tonkin, George, U. S. Biological Survey, 209-211 Federal Bldg., Moline, Ill...1935
Tyler, Dr. Winsor M., 112 Pinckney St., Boston, Massachusetts.....1914
Urner, Charles A., 596 Westminster Ave., Elizabeth, New Jersey.....1928
Van Tyne, Dr. Josselyn, Museum of Zoology, Ann Arbor, Michigan.....1922
Visscher, Dr. Paul, Biological Laboratory, Western Reserve University, Cleveland, Ohio.....1924
Warren, Edward R., 1511 Wood Ave., Colorado Springs, Colorado.....1911
Weber, Alois J., 904 Grand Ave., Keokuk, Iowa.....1928
Webster, Walter A., Route 1, Sycamore Lawn Farm, Quaker City, Ohio.....1935
Welds, H. B., 229 42nd St., Sandusky, Ohio.....1930
Wetherill, Milton, Kayenta, Arizona.....1935
Wetmore, Dr. Alexander, U. S. National Museum, Washington, D. C.....1903
Weydemeyer, Winton, Fortine, Montana.....1930
Wheeler, Leslie, Lake Forest, Illinois.....1934
White, Francis Beach, St. Paul's School, Concord, New Hampshire.....1926
Wilson, Frank Norman, 804 Lawrence St., Ann Arbor, Michigan.....1924
Wilson, Prof. Gordon, 1434 Chestnut St., Bowling Green, Kentucky.....1925
Wineman, A., 150 Michigan Ave., Detroit, Michigan.....1934
Wing, Leonard W., College of Agriculture, University of Wisconsin, Madison, Wisconsin.....1924
Wood, Dr. Casey A., E. W. S. Library, McGill University, Montreal, Quebec..1924
Wright, Mrs. George M., 2701 Claremont Blvd., Berkeley, California.....1934
Yoder, William H. Jr., 859 Granite St., Philadelphia, Pennsylvania.....1926
Zimmerman, Harold A., 915 W. Gilbert St., Muncie, Indiana.....1932

Associate Members

Adams, I. C. Jr., 1600 Hinkson St., Columbia, Missouri.....1933
Alexander, Gordon, Dept. of Biology, University of Colorado, Boulder, Colo...1936
Allen, A. F., 108 Terrace Apartments, Sioux City, Iowa.....1925
Allert, Oscar P., Route 1, McGregor, Iowa.....1923
Amadon, Dean, Route 4, Franklinville, New York.....1935
Ammann, George Andrew, Museum of Zoology, Ann Arbor, Michigan.....1935
Angus, H. L., 617 Payson Ave., Quincy, Illinois.....1933
Applegate, Wilson, Rhinebeck, New York.....1935
Austin, Dr. Oliver L., Tuckahoe, Westchester Co., New York.....1930
Badger, T. Hallett, Birds Nest, Virginia.....1935
Bailey, Florence Meriam, 1834 Kalorama Rd., Washington, D. C.....1911

Bailey, Mrs. Mary L., 511 23rd St., Sioux City, Iowa....1918
Baker, John H., 1165 5th Ave., New York City....1930
Baker, William C., 223 W. Pershing St., Salem, Ohio....1931
Ball, William H., 1861 Ingleside Terrace N. W., Washington, D. C....1924
Ballard, J. O., 5388 Waterman Ave., St. Louis, Missouri....1935
Banks, Robert D., 310 East 5th St., Superior, Wisconsin....1934
Barber, Bertram Alpha, 350 West St., Hillsdale, Michigan....1923
Barnett, Dorothy I., Shorewood High School, Milwaukee, Wisconsin....1933
Bassett, Mrs. V. H., 1010 E. Park Ave., Savannah, Georgia....1931
Batchelder, C. F., 7 Kirkland St., Cambridge, Massachusetts....1927
Baumgartner, Frederick M., 629 E. Grand River, East Lansing, Michigan....1935
Beebe, Ralph, 353 Salliotte St., Ecorse, Michigan....1924
Beeghly, J. L., Boardman Rd., Youngstown, Ohio....1933
Behle, William H., 2593 Life Sciences Bldg., University of California, Berkeley, California....1935
Bellrose, Frank, Jr., 1220 W. Madison St., Ottawa, Illinois....1935
Benedict, Mrs. Howard Smith, 18320 Kinsman Road, Shaker Heights, Ohio....1926
Bennett, Logan J., Zoology Dept., Iowa State College, Ames, Iowa....1934
Bennitt, Prof. Rudolf, Dept. of Zoology, University of Missouri, Columbia, Missouri....1932
Benson, Seth B., Museum of Vertebrate Zoology, Berkeley, California....1930
Bergner, Harold J., 420 Warwood Ave., Wheeling, West Virginia....1934
Berner, Glenn, 121 East Front St., Jamestown, North Dakota....1930
Berolzheimer, D. D. Jr., 234 Woodmere Blvd., N., Woodmere, New York....1935
Bicking, Charles A., 1006 W. 8th St., Wilmington, Delaware....1933
Bird, Otto A., 1510 Harding Rd., Ann Arbor, Michigan....1932
Birkeland, Henry, Route 2, Nevada, Iowa....1934
Black, Charles Theodore, 3836 Lowell Ave., Chicago, Illinois....1935
Blanchard, Dr. Frank N., Department of Zoology, University of Michigan, Ann Arbor, Michigan....1928
Blincoe, Mrs. Benjamin J., Route 13, Dayton, Ohio....1926
Bodine, Miss Margaret L., Rittershouse Plaza, 19th and Walnut Sts., Philadelphia, Pennsylvania....1930
Boggs, I. B., Oglebay Hall, Morgantown, West Virginia....1933
Bohning, Leonard L., Route 3, Box 350, Knox, Indiana....1935
Bolt, Benjamin F., 5300 Brookside Blvd., Kansas City, Missouri....1935
Book, Dr. R. D., Corning, Ohio....1933
Bordner, Mrs. Robert I., Hudson, Iowa....1930
Borror, Dr. Donald J., Dept. of Zoology and Entomology, Ohio State University, Columbus, Ohio....1927
Boulton, Rudyard, Field Museum, Chicago, Illinois....1922
Bowman, Lawrence L., Route 7, Orchard Hills, North Canton, Ohio....1935
Brady, Dr. John A., St. Augustine College, Lakewood, Ohio....1925
Braly, John, De Poe Bay, Oregon....1927
Brasher, Rex, Chickadee Valley, Kent, Connecticut....1926
Braund, F. W., 1022 Central Ave., Cleveland, Ohio....1935
Breese, Russell, Delaware, Ohio....1933
Breslau, Leo A., % Laurel Printing Co., 480 Canal St., New York, N. Y....1933
Brokaw, Howard P., 614 Mt. Prospect Ave., Newark, New Jersey....1935
Brookins, Albert M., Hastings Museum, Hastings, Nebraska....1935
Brooks, A. B., Oglebay Park, Wheeling, West Virginia....1931
Brooks, Maurice, Dept. Zoology, West Virginia, Morgantown, West Virginia....1926
Broomhall, W. H., Stockport, Ohio....1926
Brown, J. Wilcox, White Oaks, Montchanin, Delaware....1932
Brown, Ralph M., V. P. I., Blacksburg, Virginia....1935
Brown, Robert B. Jr., 806 Rosewood Ave., Winnetka, Illinois....1935
Brown, Thomas D., Roanoke College, Salem, Virginia....1935
Brown, Mrs. William, Edgewater Park, Celina, Ohio....1936
Bruce, James A., 557 Spring St., Wooster, Ohio....1929
Buker, Myron, Adamsville, Ohio....1935
Bujak, B. J., 932 N. Fairfield Ave., Humbolt Park Sta., Chicago, Illinois....1935

Bullock, D. J., Commodore Hotel, Des Moines, Iowa....1932
Burt, W. H., Museum of Zoology, Ann Arbor, Michigan....1928
Bush, Lee, Cambria, Illinois....1935
Cain, B. C., Box 796, Oakland, California....1934
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Campbell, S. H., Oak Grove, Louisiana....1934
Campbell, John S., Bienville, Louisiana....1932
Campbell, Louis W., 304 Fearing Blvd., Toledo, Ohio....1926
Capt, Lucile, Box 476, Baylor College, Belton, Texas....1935
Carlson, Prof. Carl Olof, Dept. of Biology, Doane College, Crete, Nebraska....1923
Carpenter, J. Richard, Lincoln College, Oxford University, England....1934
Carter, John D., Lansdowne, Pennsylvania....1930
Cartwright, Bertram William, 238 Guilford St., Deer Lodge, Winnipeg, Can...1930
Case, Rodman C., Route 1, Troy, Pennsylvania....1935
Chamberlain, Glen D., Suite 20, 22 Academy St., Presque Isle, Maine....1930
Chapman, Floyd B., 1944 Denune Ave., Columbus, Ohio....1932
Chambers, W. Lee, 2068 Escarpa Drive, Eagle Rock, Los Angeles, Calif....1909
Chase, Dr. Warren W., Soil Conservation Service, 307 Fleming Bldg., Des Moines, Iowa....1936
Cheathum, Mrs. Edith, % Biology Dept., Southern Methodist University, Dallas, Texas....1936
Chutter, Miss Mildred C., Box 229, Athens, Ohio....1936
Clapp, Alston, Sr., 1115 Cotton Exchange Bldg., Houston, Texas....1934
Clark, Mrs. C. C., 922 N. Third St., Burlington, Iowa....1925
Clarke, C. H. D., Goderich, Ontario....1932
Clayton, Miss Luella B., Feasterville, Pennsylvania....1930
Clebsch, Alfred, Route 1, Clarkesville, Tennessee....1935
Clippinger, Miss Florence, 4300 Midway Ave., Dayton, Ohio....1933
Clout, G. J., 89 North St., St. Catharines, Ontario....1935
Clow, Miss Marion, Box 163, Lake Forest, Illinois....1929
Coggin, Miss Mattie, 35th St. and Holly Rd., Virginia Beach, Virginia....1935
Cole, Harry M., 3016 Capital Ave., Cheyenne, Wyoming....1935
Coles, Victor, 2910 Grasselli Ave., Cincinnati, Ohio....1929
Collett, Grace, 37 W. Tulane Rd., Columbus, Ohio....1934
Compton, Lawrence V., Box 1151, Soil Conservation Service, Gallup, N. Mex...1923
Compton, Lelia A., 846 E. Bowman St., Wooster, Ohio....1930
Conant, Roger, Toledo Zoological Society, Toledo, Ohio....1930
Conklin, Charles, Canal Winchester, Ohio....1933
Cook, Fannye E., Research Assistant, State Fish and Game Commission, Jackson, Mississippi....1925
Converse, Charles D., Amlin, Ohio....1935
Cook, G. M., 2301 Elm St., Youngstown, Ohio....1923
Cook, Mrs. Horace P., 412 W. 11th St., Anderson, Indiana....1931
Cox, Rodman D., 785 South Ave., Rochester, New York....1933
Craig, Gerald S., Teachers College, Columbia University, New York City....1932
Crane, Francis V., South St., Needham, Massachusetts....1932
Cunningham, James V., 4425 Main St., Kansas City, Missouri....1935
Curl, Lawrence A., Quincy, Ohio....1932
Currier, Edmonde S., 8541 N. Chicago Ave., Portland, Oregon....1930
Curtis, Elizabeth L., 5648 Beach Drive, Seattle, Washington....1935
Dalke, Dr. Paul D., U. S. Biological Survey, Connecticut State College, Storrs, Connecticut....1936
Dambach, Charles A., Burton, Ohio....1934
Damon, David, Box 65, Keystone, South Dakota....1933
Danner, Mrs. Mary S., 1646 Cleveland Ave. N. W., Canton, Ohio....1921
Davidson, W. M., Route 1, Silver Spring, Maryland....1933
Davis, Mrs. L. Irby, Box 669, Harlingen, Texas....1933
Davis, Russel S., Clayton, Illinois....1932
Dawley, Jean Wilson, 13962 Clifton Blvd., Lakewood, Ohio....1931
Dawley, Jessie Sprague, 1002 Garfield St., Madison, Wisconsin....1935
Dawson, Sallie, 807 N. 4th St., Terre Haute, Indiana....1933

Deaderick, Dr. William H., 36 Circle Drive, Hot Springs, Arkansas....1936
Denton, Prof. J., Dept. of Zoology, University of Georgia, Athens, Georgia....1935
Devitt, O. E., 31 Willowbank Blvd., Toronto, Ontario....1935
Dille, Fred M., Rapid City, South Dakota....1912
Dingle, Edward von Seibold, Huger, South Carolina....1927
Dole, J. Wilbur, 51 E. Stone St., Fairfield, Iowa....1930
Dongan, L. M., 940 Maple Place, St. Louis, Missouri....1935
DuBois, A. Dawes, Route 2, Christmas Lake Rd., Excelsior, Minnesota....1935
Dyer, Mrs. Minnie M., Byington, Tennessee....1930
Easton, Robert S., 904 Moss Ave., Peoria, Illinois....1936
Eastwood, Sidney K., 301 S. Winebiddle Ave., Pittsburgh, Pennsylvania....1928
Edge, Mrs. Charles Noel, 136 E. 67th St., New York, N. Y....1931
Edson, J. M., 90 Marietta Road, Bellingham, Washington....1928
Edwards, Mrs. W. H., Fairhope, Alabama....1925
Eheim, J. M., 236 S. Adams St., Hutchinson, Minnesota....1926
Eike, James, P. O. Box 4, Woodbridge, Virginia....1933
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Ellerman, Alexander H., Sr., 1021 Lincoln St., Piqua, Ohio....1933
Elrod, Mrs. Walter DeWitt, Box 103, Okmulgee, Oklahoma....1923
Emery, F. H., 620 Euclid Ave., Toronto, Ontario....1933
Engleby, T. L., 1002 Patterson Ave., Roanoke, Virginia....1934
Erickson, Mary M., Museum of Vertebrate Zoology, University of California, Berkeley, California....1930
Evans, Dr. Evan M., 550 Park Ave., New York, N. Y....1929
Evins, Samuel N., 38 E. 14th St., Atlanta, Georgia....1921
Fabert, Harry John, 413 Linwood Ave., Columbus, Ohio....1932
Feighner, Lena Veta, 298-1 S. Tremont, Kansas City, Missouri....1935
Felker, J. O., Route 1, Box 403, Clayton, Missouri....1934
Felton, W. R., 1709 Summit St., Sioux City, Iowa....1934
Ferguson, M. S., 301 Natural History Bldg., Urbana, Illinois....1936
Finster, Ethel B., Ashville Normal School, Ashville, North Carolina....1930
Fisher, Warren, Carlisle, Kentucky....1935
Fitzpatrick, Prof. Fred L., Teachers College, Columbia Univ., New York, N. Y....1924
Fleetwood, Raymond J., Soil Conservation Service, Paducah, Kentucky....1934
Fletcher, Alma, 3506 Hawthorne Ave., St. Louis, Missouri....1935
Foote, M. E., 11 Birch Crescent, Rochester, New York....1932
Force, Edith R., 3021 E. 8th St., Tulsa, Oklahoma....1931
Ford, Louise Pettigrew, Barnwell Ave., Aiken, South Carolina....1921
Forsthoefel, Paul, 303 East Fulton St., Celina, Ohio....1932
Foster, George, 2352 E. Magnolia Ave., Knoxville, Tennessee....1935
Franks, Roscoe W., State Civil Service Commission, Columbus, Ohio....1932
Frazer, Dr. T. Atchinson, Marion, Kentucky....1934
Frothingham, Mrs. Randolph, 56 Sargent Crossway, Brookline, Massachusetts....1932
Fryklund, P. O., Roseau, Roseau Co., Minnesota....1926
Furniss, Owen C., 2203 1st Ave., Saskatchewan, Canada....1934
Gander, Frank F., Balboa Park, San Diego, California....1928
Ghigi, Alessandro, R. Universita, Bologna, Italy....1931
Gigstead, Gill, Havana, Illinois....1936
Gilbert, Winifred, 524 W. 24th St., Cedar Falls, Iowa....1936
Giles, Norman H., Jr., 959 Drewery St., N. E., Atlanta, Georgia....1930
Gill, Goeffrey, 24 Overlook Drive, Huntington, Long Island, New York....1934
Gillett, Francis C., 920 Princeton St., Lansing, Michigan....1935
Gillette, Fredericka B., 1319 Forest Ave., Ann Arbor, Michigan....1928
Gleason, Mrs. C. H., Route 3, Berrywood Wilds, Grand Rapids, Michigan....1932
Glenn, Robert W., 509 Orchard Ave., Avalon, Pittsburgh, Pennsylvania....1934
Goerlitz, George, 520 E. Main St., Boonville, Indiana....1934
Goldsmith, G. W., Box 1611, University Station, Austin, Texas....1931
Gordon, Dr. Robert B., Department of Botany, Ohio State University, Columbus, Ohio....1931
Gowen, Carl, 606 S. Illinois Ave., Carbondale, Illinois....1932
Grant, Cleveland P., 620 Greenup St., Covington, Kentucky....1928

Gray, Allan L., Orleans, Nebraska....1932
Greene, Earle R., New Holland, North Carolina....1930
Green, Horace O., 220 North Ave., Wakefield, Massachusetts....1935
Gresham, Burt, Winnipeg Free Press, Winnipeg, Manitoba....1934
Grimes, S. A., 4661 Attleboro St., Jacksonville, Florida....1924
Gross, Dr. Alfred O., Bowdoin College, Brunswick, Maine....1927
Guion, George Seth, 1701 American Bank Bldg., New Orleans, Louisiana....1935
Gunderson, Ethel, Barnesville, Minnesota....1935
Guy, Mrs. Katherine Christie, Box 416, Beckley, West Virginia....1934
Habeger, Ruth, 401 W. Main, Marshalltown, Iowa....1931
Hagar, Mrs. Jack, Rockport, Texas....1930
Hague, Florence, Sweet Briar College, Sweet Briar, Virginia....1931
Hainsworth, William P., 214 Railroad Ave., North Andover, Massachusetts....1930
Hale, Arthur T., Jr., Box 753, Mission, Texas....1935
Hall, Watson, Soil Conservation Service, Coon Valley, Wisconsin....1934
Haller, Carl W., Route 1, Short Creek, Virginia....1934
Hallman, R. C., P. O. Box 847, St. Augustine, Florida....1928
Hambleton, Prof. J. C., 380 W. 8th Ave., Columbus, Ohio....1932
Hamilton, Dr. William John, Jr., Department of Zoology, Cornell University, Ithaca, New York....1933
Hamerstrom, F. J., Jr., P. O. Box 281, Necedah, Wisconsin....1934
Hanawalt, Prof. Fred A., Zoology Dept., Otterbein College, Westerville, Ohio....1932
Handlan, Mrs. John W., Oglebay Park, Wheeling, West Virginia....1934
Happ, Prof. George B., The Principia College, Elsah, Illinois....1935
Harkin, J. B., Commissioner, Dept. of Interior, Ottawa, Canada....1924
Harper, Dr. Francis, 224 S. Chester Rd., Swarthmore, Pennsylvania....1930
Harris, Dr. A. Trevenning, 738-40 Gary State Bldg., Gary, Indiana....1936
Harris, C. L., 921 W. Central, Eldorado, Kansas....1928
Harris, Mrs. W. Gray, 332 Main St., Worcester, Massachusetts....1932
Hartsook, Mrs. Fred P., Winterset, Iowa....1934
Hayward, W. J., Box 1282, Sioux City, Iowa....1913
Head, Glenn B., 337 Haskin St., Kalamuth Falls, Oregon....1935
Heising, Clara M., Apt. 208, 5540 Pershing Ave., St. Louis, Missouri....1932
Hemphill, Frederick A., 125 Broad St., Elizabeth, New Jersey....1928
Henderson, Grant, Route 6, Greensburg, Indiana....1930
Henderson, W. C., 8 Magnolia Parkway, Chevy Chase, Maryland....1928
Henry, C. J., P. O. Box 34, Upham, North Dakota....1933
Herrick, Eleanor E., Box 729, Woodmere, Long Island, New York....1935
Hicks, Mrs. E. H., Fredricktown, Ohio....1932
Hicks, John N., West Point, Illinois....1935
Hiett, Lawrence D., 3758 Brookside Rd., Toledo, Ohio....1930
Hill, Howard, Deslodge, Missouri....1933
Hill, Julian W., 707 Coverdale Rd., Wilmington, Delaware....1935
Hillmer, Davis B., 454 Colburn Place, Detroit, Michigan....1926
Hilton, Dr. Davie C., 305 Richards Blk., Lincoln, Nebraska....1918
Hinchman, Richard May, 501 Randolph Ave., Milton, Massachusetts....1931
Hoag, Ena, P. O. Box 407, Pacific Grove, California....1934
Hobson, Mrs. L. G., 2035 Alta Ave., Louisville, Kentucky....1935
Holland, Harold May, Box 515, Galesburg, Illinois....1915
Holt, Prof. William P., Bowling Green, Ohio....1932
Howard, William J., % National Park Service, Richmond, Virginia....1935
Hudson, George E., Dept. Zoology and Anatomy, University of Nebraska, Lincoln, Nebraska....1933
Huey, Laurence M., Natural History Museum, Balboa Park, San Diego, California....1932
Huggitt, Floyd C., Bellevue, Michigan....1933
Hughes, George T., Box 153, Plainfield, New Jersey....1929
Hunter, Lawrence E., Dallas City, Illinois....1934
Hyndway, Mrs. Eleanor, Route 2, Marcus, Iowa....1933
Ijams, H. P., Box 1150, Knoxville, Tennessee....1924
Ingersoll, Albert M., 908 F St., San Diego, California....1921
Jackson, Norman R., Box 215, Camp Verde, Arizona....1935

James, Mrs. A. O., Chatham, Virginia....1931
Janzen, Daniel H., Michigan State College, East Lansing, Michigan....1934
Jelier, F. P., Groote Visscherystraat 19a, Rotterdam, Holland....1931
Jenks, Randolph, Mt. Kemble, Morristown, New Jersey....1934
Jensen, J. P., Box 364, Dassel, Minnesota....1926
Jessman, L. M., 4168 W. Jefferson, Ecorse, Michigan....1935
Johnson, Carl H., 3796 Lowell Rd., Cleveland, Ohio....1935
Johnson, D. E., 2269 Grandview Rd., Cleveland Heights, Ohio....1934
Johnson, D. Elmer, 266 Lava Hot Springs, Idaho....1934
Johnson, Frank, 1202 Kenwood Ave., Fort Wayne, Indiana....1935
Johnson, Mrs. Irene W., 38 Portland Place, St. Louis, Missouri....1931
Johnson, Robert A., State Normal School, Oneonta, New York....1930
Jones, F. M., Wise, Virginia....1933
Jones, Gordon Willis, Ellwood Farms, Wilderness, Virginia....1933
Jones, Harold C., 352 W. College St., Oberlin, Ohio....1929
Jones, John C., 3224 19th St. N. W., Washington, D. C....1931
Jones, S. Paul, 509 W. Ave., North, Waukesha, Wisconsin....1921
Jotter, Lois, 1317 S. University St., Ann Arbor, Michigan....1935
Kamm, Mrs. Oliver, 365 Lake Shore Drive, Grosse Point Farms, Michigan....1934
Kearns, Lucy Pendleton, Lynnehaven, P. O., Lynnehaven, Virginia....1935
Keller, L. Floyd, Zion National Park, Springdale, Utah....1931
Kelly, Mrs. George A., 2300 LaSalle Gardens North, Detroit, Michigan....1935
Kellog, Dale C., Box 343, Norwalk, Ohio....1932
Kennedy, H. N., P. O. Box 294, Rosslyn, Virginia....1935
Kiessling, Victor R., 720 E. Moreland St., Phoenix, Arizona....1935
Kingsbury, Elizabeth W., 40 Monroe St., Apt. CG8, New York, N. Y....1933
Klepfer, Ward, Box 1031, Granville, Ohio....1934
Knapp, Elmer, Route 2, Troy, Pennsylvania....1930
Knappen, Phoebe, 2925 Tilden St., N. W., Washington, D. C....1926
Knight, Prof. Harry H., Dept. Zoology and Entomology, Iowa State College, Ames, Iowa....1926
Komarek, Roy V., Chicago Academy of Sciences, Lincoln Park, Chicago, Ill....1935
Kriebel, Ralph M., 1111 North St., Bedford, Indiana....1935
Krug, Carl B., % George Krug, Minonk, Illinois....1930
Kubichek, W. F., 164 19th St., S. W., Cedar Rapids, Iowa....1926
Kummerlowe, Dr. Hans, Cichorius Strasse 6 III, Leipzig, Germany....1931
Lee, Addie, 2111 Dixie Place, Nashville, Tennessee....1933
Lee, Henry E., Box 831, Rapid City, South Dakota....1936
Leedy, Charles A., % The Telegram, Youngstown, Ohio....1927
Lewis, Merriam G., Langhorne Place, Salem, Virginia....1930
Lincoln, Frederick C., U. S. Biological Survey, Washington, D. C....1914
Linsdale, Dr. Jean M., Museum of Vertebrate Zoology, University of California, Berkeley, California....1928
Livingston, Helen, 208 S. 4th St., Monmouth, Illinois....1935
Lloyd, C. K., 11 N. Elm St., Oxford, Ohio....1925
Lloyd, Hoyes, 582 Mariposa Ave., Rockcliffe Park, Ottawa, Ontario....1922
Lodge, William R., Silver Lake Blvd., Route 1, Cuyahoga Falls, Ohio....1935
Lomax, Dr. Claude C., 503 S. Willow Rd., Evansville, Indiana....1921
Long, Charles F., 203 E. Broad St., Columbus, Ohio....1934
Long, Mary A., 526 E. First St., Royal Oak, Michigan....1932
Long, William H., Jr., 1612 Morton Ave., Ann Arbor, Michigan....1933
Low, Seth H., Arrowwood Waterfowl Refuge, Kensal, North Dakota....1931
Lubin, S. F., 106 Chapin St., Binghamton, New York....1934
Lumley, Ellsworth, High School, Great Falls, Montana....1935
Lundquist, Arthur, Peabody Hospital, Webster, South Dakota....1930
MacLoghlin, Mrs. F. E., 43 Inglewood Drive, Hamilton, Ontario....1928
MacLulick, D. A., Royal Ontario Museum of Zoology, Toronto, Ontario....1933
Magath, Dr. Thomas B., Mayo Clinic, Rochester, Minnesota....1935
Malley, Philip P., 2925 Wellman Ave., New York City....1935
Marburger, Clifford, Denver, Lancaster Co., Pennsylvania....1924
Marden, Aaron, Eagle Island, South Harpswell, Maine....1933
Marshall, Raymond O., % Ralph Walter, Route 4, Lisbon, Ohio....1930

Maslowski, Karl, 950 Glenwood Ave., Cincinnati, Ohio....1934
Mayr, Dr. Ernst, American Museum of Natural History, New York, N. Y....1933
McCamey, Franklin, Jr., 1637 Netherwood Ave., Memphis, Tennessee....1935
McCann, Horace D., Box 175, Paoli, Pennsylvania....1933
McCarthy, T. J., 1524 Haghitt Ave., Superior, Wisconsin....1935
McClanahan, Robert C., 1700 E. Avery St., Pensacola, Florida....1935
McGill, Dr. J. T., Vanderbilt University, Nashville, Tennessee....1930
McIntosh, Duncan, Fairhope, Alabama....1931
McKay, A. K., Chambers Co., Cove, Texas....1935
McLain, Miss Sallie R., 1512 Franklin Rd., S. W., Roanoke, Virginia....1935
McLaughlin, Vincent, 1813 Kensington Ave., Youngstown, Ohio....1935
McNeil, Dr. Charles A., 111 W. Fourth St., Sedalia, Missouri....1914
McNutt, Dorothea R., Greensboro College, Greensboro, North Carolina....1935
Meltreat, Burton W., Paullina, Iowa....1930
Mendenhall, Eugene W., 97 Brighton Rd., Columbus, Ohio....1932
Menninger, William C., 1724 Collins Ave., Topeka, Kansas....1935
Meyer, Miss Adelphia, 6 S. 14th St., Nashville, Tennessee....1931
Michener, Harold, 418 N. Hudson Ave., Pasadena, California....1926
Mickey, Prof. A. B., Zoology Dept., Univ. of Wyoming, Laramie, Wyoming....1935
Miller, Alden H., Museum of Vertebrate Zoology, Berkeley, California....1930
Miller, Empey, Freeland, Michigan....1931
Miller, Robert C., University of Washington, Seattle, Washington....1935
Milnes, Hattie K., 331 Gowen Ave., Philadelphia, Pennsylvania....1935
Moffitt, James, 1879 Broadway, San Francisco, California....1931
Mohr, Carl O., Illinois Natural History Survey, Urbana, Illinois....1936
Molloy, Mrs. R. B., 418 W. Third Ave., Corsicana, Texas....1930
Monk, Harry C., 3108 Long Blvd., Nashville, Tennessee....1920
Monroe, Burt, 110 S. 5th St., Louisville, Kentucky....1935
Monson, Gale, Box 432, Safford, Arizona....1933
Moore, Miss Dora, 60 E. Mulberry St., Athens, Ohio....1934
Morse, Frank E., 939 Elm St., Manchester, New Hampshire....1926
Mounts, Mrs. Beryl Taylor, Ballard Normal School, Macon, Georgia....1923
Mouseley, William H., 4073 Tupper St., Westmount, Montreal, Quebec....1922
Mueller, Walter J., 2043 N. Project Ave., Milwaukee, Wisconsin....1936
Mulaik, Dorothea Upp, Box 155, Edinburg, Texas....1933
Munro, J. A., Okanagan Landing, British Columbia....1935
Munter, Capt. W. H., U. S. Coast Guard, 806 Wilkins Bldg., Washington, D. C....1933
Murie, Adolph, 304 Underwood Bldg., San Francisco, California....1932
Murie, O. J., Jackson, Wyoming....1934
Murphey, Dr. Eugene E., 432 Telfair St., Augusta, Georgia....1935
Murphey, Paul, 10 De Forest Ave., Summit, New Jersey....1936
Murray, Rev. J. J., Lexington Presbyterian Church, Lexington, Virginia....1931
Myrus, A. A., 81 Ford Ave., Oneonta, New York....1934
Naeser, Charles R., 515 Bash Court, Champaign, Illinois....1932
Nelson, Arnold L., Food Habits Research, U. S. Biological Survey, Washington, D. C....1932
Nelson, Miss Viola, 35 W. Washington, Athens, Ohio....1935
Nessle, James, 1417 Prospect Ave., Toledo, Ohio....1936
Nicholson, Donald J., 534 S. Eola Drive, Orlando, Florida....1934
Norton, Arthur H., 22 Elm St., Portland, Maine....1934
Oakes, Mervin E., State Normal School, Freedonia, New York....1933
Odum, Eugene, Box 792, Chapel Hill, North Carolina....1930
Oliver, Mary C., 909 Santa Rita St., Silver City, New Mexico....1934
Ortman, Mrs. Enid, 4660 S. Franklin, Englewood, Colorado....1930
Overing, Robert, Landover, Maryland....1930
Owens, C. M., Route 4, Monticello, Arkansas....1935
Owre, Oscar, Jr., 2625 Newton Ave., South, Minneapolis, Minnesota....1935
Packard, Stanley E., Troy, Pennsylvania....1936
Palmer, Miss Mary C., 760 Midlothian Blvd., Route 2, Youngstown, Ohio....1927
Palmer, Ralph S., Route 1, Brunswick, Maine....1934
Partridge, James A., Normal School, Hamilton, Ontario....1935

Patrick, Dr. Leon, Smith-Crote Bldg., Orange, California....1931
Patterson, J. E., 341 Giannini Hall, Berkeley, California....1930
Peasley, Mrs. Harold, 1807 6th Ave., Des Moines, Iowa....1934
Peet, Dr. Max M., 2030 Hill St., Ann Arbor, Michigan....1935
Pennell, Miss Edna, 503 N. Main St., Mount Vernon, Ohio....1931
Pepper, William, Jr., 110 Glenview Ave., Wyncote, Pennsylvania....1932
Perry, Harold E., 1329 Ethel St., Glendale, California....1932
Peterson, Alfred, Lock Box 211, Pipestone, Minnesota....1931
Peterson, Mervin H., Payson, Utah....1936
Peterson, N. Theodore, 80 Oaklawn Ave., Battle Creek, Michigan....1931
Pickens, A. L., Paducah Teachers College, Paducah, Kentucky....1927
Pierce, Fred J., Winthrop, Iowa....1920
Pierce, John T., Anita, Iowa....1930
Pierce, Wright M., Box 343, Claremont, California....1926
Pirnie, Dr. Miles D., Director, Kellogg Bird Sanctuary, Augusta, Michigan....1928
Poenitz, Hans, Frankfurter Strasse 2, III, Leipzig, Germany....1930
Poland, Lloyd, 526 W. Burke St., Martinsburg, West Virginia....1934
Poole, Frazer G., Federalsburg, Maryland....1936
Poor, Hustace H., 112 Park Ave., Yonkers, New York....1935
Potter, Julian K., 437 Park Ave., Collingswood, New Jersey....1915
Pratt, D. R., McKinley High School, Canton, Ohio....1932
Presnall, Mrs. Clifford C., Springdale, Utah....1930
Price, Charles E., Woodward Ave., Moylan, Pennsylvania....1935
Price, John B., 532 Alvarado, Stanford University, California....1931
Prill, Dr. A. G., Main St., Scio, Oregon....1933
Quattlebaum, W. D., 1925 Paloma St., Pasadena, California....1930
Rahe, Carl W., 4666 Turney Rd., Cleveland, Ohio....1931
Ramsden, Charles Theodore, Apartado 146, Guantanamo, Cuba....1914
Rapp, F. W., Vicksburg, Michigan....1926
Ray, Edward M., 3013 Wentworth Ave., Louisville, Kentucky....1935
Reeder, J. T., 318 College Ave., Houghton, Michigan....1926
Reeder, John P., 502 Seldon Road, Iron River, Michigan....1934
Reis, C. O., 646 Juanita Ave., Los Angeles, California....1931
Rice, Mrs. Bird Wells, 103 S. Miller St., Cyanthiana, Kentucky....1935
Rich, Dr. Guy C., 1820 El Cerrito Place, Hollywood, California....1914
Richardson, Hubert, 182 Rusholme Rd., Toronto, Ontario....1931
Ricks, Jesse J., 30 East 42nd St., New York, N. Y....1931
Ritter, John H., 1015 Old Orchard Ave., Dayton, Ohio....1932
Roasch, Gilbert O., Science Hall, University of Wisconsin, Madison, Wisc....1931
Rogers, Mabel T., 200 Columbia St., Milledgeville, Georgia....1935
Rosewall, Prof. O. W., Dept. of Zoology, Louisiana State University, Baton Rouge, Louisiana....1931
Ross, Hollis T., 109 S. 3rd St., Lewisburg, Pennsylvania....1933
Ross, Julia E., Box 82, Kimball, Minnesota....1920
Russel, Henry N., Jr., 79 Alexander St., Princeton, New Jersey....1932
Russell, Dr. W. L., Box 22, Rhome, Texas....1935
Sanders, R. D., U. S. Forest Service, Rhinelander, Wisconsin....1935
Sargent, William Dunlap, Entomology Dept., Cornell Univ., Ithaca, N. Y....1931
Sattire, A. M., Concordia College, Moorhead, Minnesota....1934
Saunders, Aretas A., 48 Longview Ave., Fairfield, Connecticut....1934
Saunders, Dr. George B., Box 753, Lake Charles, Louisiana....1926
Schafer, John T., Route 2, Port Byron, Illinois....1926
Schaller, R. A., 124 S. College Drive, Bowling Green, Ohio....1930
Schneider, Miss Evelyn, 227 Alta Ave., Louisville, Kentucky....1935
Schultz, G. J., Sutherland, Iowa....1934
Schultz, Miss Helen, Box 105, State Normal College, Fredericksburg, Va....1929
Sedgwick, Leibert D., I. S. & S. C. Home, Knightstown, Indiana....1933
Serbousek, Lillian, 1226 2nd St. S. W., Cedar Rapids, Iowa....1935
Shadle, Prof. Albert R., Biology Dept., Univ. of Buffalo, Buffalo, New York....1930
Shaftesbury, Prof. Archie D., N. C. C. W., Greensboro, North Carolina....1930
Shaw, Mrs. Elizabeth M., 2417 Rosewood Ave., Richmond, Virginia....1931
Sheppard, R. W., 1805 Mouland Ave., Niagara Falls, Ontario....1933

Shields, T. H., 150 18th St., Warwood, Wheeling, West Virginia....1934
Shipman, Charles W., 114 Ridge Rd., Willoughby, Ohio....1930
Shirling, Prof. A. E., 3849 E. 62nd St., Kansas City, Missouri....1924
Shoop, Cora E., Steelton, Missouri....1935
Sibley, John E., Route 2, Whittemore, Michigan....1933
Sibley, Norman O., Route 2, Whittemore, Michigan....1933
Skaggs, Merit B., 14755 Coit Rd., E. Cleveland, Ohio....1934
Slack, Miss Mabel, 1004 Everett Ave., Louisville, Kentucky....1934
Smith, Dr. A. F., Manning, Iowa....1934
Smith, Mrs. Florence L., Cincinnatus, New York....1935
Smith, Herbert Allyn, 3219 Bellefontaine, Kansas City, Missouri....1932
Smith, Lewis MacCuen, 26 Benezet St., Chestnut Hill, Philadelphia, Pa....1931
Smith, Napier, % Bank of Montreal, 9 Waterloo Place, Pall Mall, London, S. W. 1, England....1928
Smith, Wendell Phillips, Wells River, Vermont....1921
Smyth, J. Adger, Salem, Virginia....1933
Snow, K. C., Route 1, Dexter, New Mexico....1932
Snyder, L. L., Royal Ontario Museum of Zoology, Bloor St. and Avenue Rd., Toronto 5, Ontario....1930
Spawn, Gerald B., Dept. of Zoology, Iowa State College, Ames, Iowa....1934
Speirs, J. Murray, 17 Wolfrey Ave., Toronto 6, Ontario....1931
Sperry, Charles C., Biological Survey, Denver, Colorado....1931
Starrett, William C., 303 Maryland Ave., Peoria, Illinois....1933
Stein, Hilda A., So. Illinois State Teachers College, Carbondale, Illinois....1933
Stein, Stanley F., Shakopee, Minnesota....1932
Stephansky, J. D., % Dept. Conservation, Newberry, Michigan....1935
Stephens, Mrs. Albert Blasdel, 1695 Filbert St., San Francisco, California....1935
Sterry, Elizabeth, Teachers College, San Marcos, Texas....1930
Stevens, O. A., State College Station, Fargo, North Dakota....1926
Stevens, Ross O., Soil Conservation Service, High Point, North Carolina....1934
Stevenson, James, 517 Braniff Bldg., National Park Service, Oklahoma City, Oklahoma....1931
Stewart, Paul A., Leetonia, Ohio....1925
Stiles, Bruce F., 3726 7th Ave., Sioux City, Iowa....1935
Stillwell, Wendell H., Mt. Vernon, Ohio....1934
Stine, Perna M., State Teachers College, Minot, North Dakota....1931
Stoner, Emerson A., Box 144, Benicia, California....1934
Stooksberry, C. L., 1814 S. Miller Ave., Alliance, Ohio....1931
Stophlet, John J., 2612 Maplewood Ave., Toledo, Ohio....1934
Storer, Dr. Tracy I., Division of Biology, University Farm, Davis, California....1928
Strickland, Laura Raymond, 578 E. Central St., Franklin, Massachusetts....1935
Stroley, Elsie A., Morristown, New Jersey....1935
Stuart, Mrs. Margaret J., Box 546, Wheaton, Illinois....1933
Stupp, Jack, Route 2, Box 1014, Clayton, Missouri....1934
Stupka, Arthur, Great Smoky Mountains National Park, Gatlinburg, Tenn....1935
Sturgeon, Myron, 259 W. 2nd St., Salem, Ohio....1934
Sturgis, Irwin, Rural, % Mrs. Ethel Van Meter, Higginsville, Missouri....1935
Sullivan, Walter F., 351 Turk St., San Francisco, California....1925
Sumner, E. L., Box 188, Menlo Park, California....1931
Sumner, E. L., Jr., Box 188, Menlo Park, California....1929
Swanson, Gustav, Wildlife Research Station, Univ. of Maine, Orono, Maine....1927
Swedenborg, Ernie D., 4905 Vincent Ave., South, Minneapolis, Minnesota....1929
Tanner, Orey, 5019 Constance St., New Orleans, Louisiana....1933
Taverner, P. A., National Museum of Canada, Ottawa, Ontario....1925
Teachenor, Dix, 1020 W. 61st St., Kansas City, Missouri....1923
Test, Dr. Frederick H., 511 Russell St., West Lafayette, Indiana....1931
Thomas, Judge Otho S., 205 S. Greene St., Rock Rapids, Iowa....1932
Thompson, Jean, 603 W. Lafayette St., Norristown, Pennsylvania....1935
Thorp, George B., Carnegie Institute of Technology, Pittsburgh, Penn....1935
Tompkins, Ivan R., U. S. Dredge Morgan, Savannah, Georgia....1931
Trautman, Milton B., Museum of Zoology, Ann Arbor, Michigan....1932
Tremps, A. D., 612 Kimball St., Sault Ste. Marie, Michigan....1932

Trimble, Ruth, Carnegie Museum, Pittsburgh, Pennsylvania....1935
Tubbs, Farley F., Dept. Conservation, Game Division, Lansing, Michigan....1935
Turtle, Lancelot J., Rosemount Khock, Belfast, Ireland....1930
Tuttle, Henry C., 31 State St., Boston, Massachusetts....1930
Tyler, B. T., 215 W. Uraka Ave., Johnson City, Tennessee....1934
Uhler, Francis M., U. S. Biological Survey, Washington, D. C....1931
Upton, Clyde, 41 Acosta Ave., Elm Grove, West Virginia....1934
Ussher, R. D., Nancy Lake Farm, King, Ontario, Canada....1934
Vann Epps, Claude A., Bazile Mills, Nebraska....1936
Van Deusen, H. M., 210 E. 68th St., New York, N. Y....1934
Vasicek, J. M., 10605 Lamontier Ave., Cleveland, Ohio....1934
Vetter, Dr. Charles, Grand View, Nyack, New York....1931
Vincent, Roch Arthur, 517 St. Lawrence Blvd., Montreal, Quebec....1931
Vogt, William, Editor Bird Lore, 1775 Broadway, New York, N. Y....1935
Wachter, William, Hotel Martin, Sioux City, Iowa....1934
Walker, W. M., Jr., Apt. 10, 1825 W. Clinch Ave., Knoxville, Tennessee....1925
Walkinshaw, Dr. Lawrence M., 1421 N. Michigan Ave., Battle Creek, Mich....1928
Wallace, Robert B., Wardman Park Hotel, Washington, D. C....1935
Wanamaker, Paul, 443 Seminole St., Oradell, New Jersey....1934
Ward, Lawrence, St. Johns, Route 1, Michigan....1934
Watters, Robinson C., Box 298, Cambridge, Maryland....1935
Watkins, Allan G., U. S. Forest Service, Lake City, Florida....1935
Watson, Lucius Howard, 4103 Sheridan Blvd., Lincoln, Nebraska....1922
Watterson, William H., 3671 Daleford Rd., Cleveland, Ohio....1929
Weaver, Richard, 3262 River Rd., Cleveland, Ohio....1936
Wells, William, Colony, Kansas....1934
Welter, Dr. Wilfred A., Teachers College, Morehead, Kentucky....1931
Wetherbee, Mrs. Kenneth B., 11 Dallas St., Worcester, Massachusetts....1930
Weyl, Edward Stern, 6506 Lincoln Drive, Mt. Airy, Philadelphia, Penn....1927
Whitaker, Ines, Hotel Robert Fulton, 228 W. 71st St., New York, N. Y....1930
Whitten, Easton W., Coffen, Illinois....1930
Wight, Howard M., School Forestry and Conservation, University of Michigan, Ann Arbor, Michigan....1935
Wilkinson, Alexander Stanley, Kapiti Island, Wellington, New Zealand....1930
Williams, Cecil S., Food Habits Research, U. S. Biological Survey, Washington, D. C....1936
Williams, Laidlaw O., Box 453, Carmel, California....1930
Williams, Noel J., Milford, Iowa....1918
Williams, Robert W., U. S. Biological Survey, Washington, D. C....1926
Willis, Myra G., 1540 D. Ave. N. E., Cedar Rapids, Iowa....1935
Willis, Warren J., 24824 89th Ave., Belle Rose, Long Island, New York....1928
Wilson, Miss Belle, 5920 Goodwin Ave., Dallas, Texas....1928
Wilson, C. W., Box 311, Warrenton, Missouri....1935
Wilson, Sue, 1010 First National Bank Bldg., Omaha, Nebr....1931
Witschi, Dr. Emil, Dept. Zoology, State University of Iowa, Iowa City, Iowa....1935
Wolfram, George S., Canal Winchester, Ohio....1932
Wood, Dr. Harold B., 3016 N. Second St., Harrisburg, Pennsylvania....1932
Wood, Mary Adele, Gates Hall, Hyde Park Sta., Chicago, Illinois....1930
Woods, W. C., Stephen, Minnesota....1934
Wood, Norman A., Museum of Zoology, University of Michigan, Ann Arbor, Michigan....1925
Woodhull, Dr. Maurice W., Cottonwood Falls, Kansas....1931
Woolman, Edward, Box 128, Haverford, Pennsylvania....1928
Work, Mrs. Robert, Bosky Acres, Barrington, Illinois....1934
Wright, Earl G., Chicago Academy of Science, Lincoln Park, Chicago, Ill....1935
Yeatter, Dr. R. E., Illinois Natural History Survey, Natural History Bldg., Urbana, Illinois....1932
Youngworth, William, 3119 E. 2nd St., Sioux City, Iowa....1934
Yunker, Emilie, 1140 Everett Ave., Louisville, Kentucky....1935
Zimmerman, Fred R., Box 102, Black River Falls, Wisconsin....1935
Zurcher, Miss Olga, 133 S. Richardson Ave., Columbus, Ohio....1933